# CAPTURE BETTER PHONE AUDIO & VIDEO

# apc

MAR 2020 #478

YOUR EXPERT GUIDE TO TODAY'S TECH

**BIG BEEFY CPUS FACE-OFF**
THREADRIPPER 3970X vs. I9-10980XE vs. RYZEN 9 3950X

**BE AN APPLE GENIUS**
58 TROUBLESHOOTING TIPS FOR ANY MAC

# 2020

MUST-HAVE TECH!

# TECH PREVIEW

## THE CPUs, GPUs, SSDs & MORE THAT WILL TRANSFORM YOUR PC

UTURE

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**BUILD YOUR FIRST PC**

EASY DIY BEGINNER'S GUIDE

*FOR THE SAVINGS AND SATISFACTION*

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**STILL ON WINDOWS 7?**

WE PRESENT THE CASE FOR LINUX

*FULL TUTORIAL AND SETUP GUIDE*

# NBN SMB Solution for VDSL2 & Ethernet WAN
## (FTTN/B, FTTP, HFC, Fixed Wireless, Satellite)

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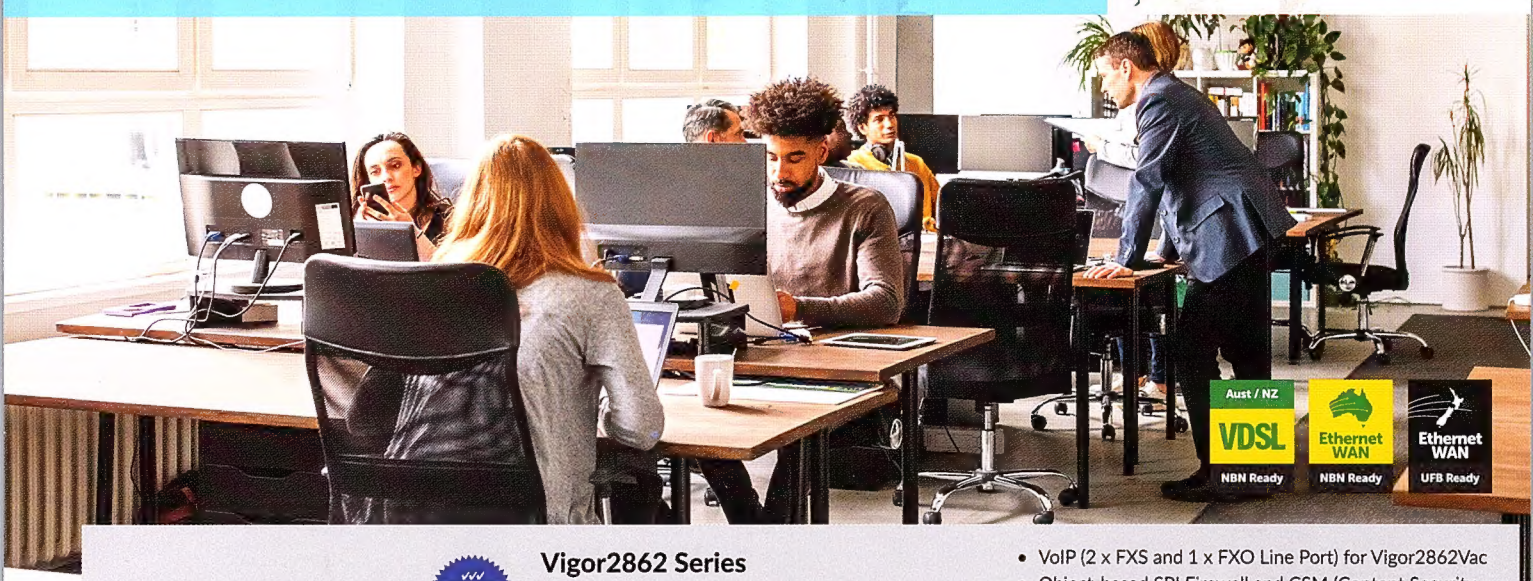



apc RECOMMENDS

### Vigor2862 Series

Multi-WAN VDSL2/ADSL2+ router with 1 x configurable GbE WAN/LAN port, 4 x GbE LAN ports, SPI Firewall, 802.11ac Wi-Fi, VoIP and 32 x VPN tunnels including 16 x SSL-VPN

32x VPN

Vigor2862Vac

- VDSL2/ADSL2+, 1 x configurable GbE WAN/LAN port, dual USB ports for failover and load-balancing
- Two USB 2.0 ports for connection to two 3.5G/4G LTE USB mobiles, FTP server and network printer
- 4 x Gigabit LAN ports with multiple subnets and 50,000 NAT sessions
- Integrated IEEE 802.11ac (AC2000) wireless Access Point; dual band; up to 1.7Gbps throughput
- IPv6 & IPv4
- Increased IP addresses (1022) and IP subnets (8)
- VoIP (2 x FXS and 1 x FXO Line Port) for Vigor2862Vac
- Object-based SPI Firewall and CSM (Content Security Management) for network security
- 16 x VLANs for secure and efficient workgroup management
- 32 x VPN tunnels (including 16 x SSL VPN tunnels) with Load Balance and Redundancy
- Fast VPN throughput, VPN load-balancing and backup for site-to-site applications
- High Availability mode
- Embedded Central VPN Management for 8 remote Vigor routers
- Central AP Management for deployment of multiple wireless VigorAPs
- Works with Smart Monitor Network Traffic Analyzer (30-nodes)
- Works with VigorACS 2 Central Management for multi-site deployment

### Vigor2762 Series

VDSL2/ADSL2+ router with 1 x configurable GbE WAN/LAN port, 3 x GbE LAN ports, SPI Firewall, 802.11ac Wi-Fi, and 2 x VPN tunnels including 2 x SSL-VPN

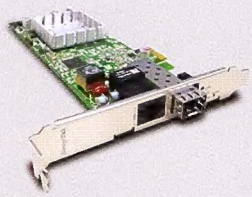
2x VPN

Vigor2762Vac

- 1 x VDSL2/ADSL2+ WAN port
- 1 x configurable GbE WAN/LAN port
- 3 x GbE LAN ports with 50,000 NAT sessions
- 2 x USB ports for 3G/4G LTE mobile broadband access, USB printer and storage
- VDSL2 vectoring
- IPv6 & IPv4
- Object-based SPI Firewall, CSM (Content Security Management) and QoS for network security
- 2 x VPN tunnels including 2 x SSL-VPN tunnels
- Integrated IEEE 802.11ac (AC1200) wireless Access Point
- SIP VoIP (2 x FXS ports)
- Works with VigorACS 2 (Central Management System)

### VigorNIC 132F

VDSL2/ADSL2+ PCI Express NIC with SPI Firewall and SFP secondary WAN port



- 1 x VDSL2/ADSL2+ WAN port
- 1 x SFP port for optic fibre or UTP interface module
- VDSL2 vectoring
- Bridging for VDSL2 and ADSL2+
- Object-oriented SPI Firewall
- IPv6 & IPv4
- Support Windows 8, Windows 10 & Ubuntu
- Multi-PVC for triple-play application
- VigorACS 2 management system

### Vigor130

VDSL2/ADSL2+ modem/router

TAIWAN EXCELLENCE 2014

- 1 x VDSL2/ADSL2+ WAN port
- 1 x Gigabit Ethernet LAN port
- VDSL2 vectoring
- Bridging for VDSL2 and ADSL2+
- Object-oriented SPI Firewall
- IPv6 & IPv4
- Works with VigorACS 2 management system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# Is the Surface Pro X pointless?

## It depends, and that's the point.

On page 28 we have a review of the Surface Pro X, which some say is sort of the unpopular stepchild of the Surface family. I've been using one for the last month myself so wanted to chuck in some personal perspective of what this device is – and isn't.

This machine is fighting a perception and viable use-case war on several fronts. It's up against the iPad Pro in many ways, and with that comes fiery fanboy arguments in comments sections and forums as it's discussed. Secondly, it's also being stacked up against the 'proper' Surface machines running a 64-bit Intel or AMD CPU. Meanwhile it's fending of a flanking attack from the 'small-Surface' – the Go – which offers competing portability. Its Venn diagram also overlaps with Chromebooks.

No wonder it's copping some heat. Really – it also goes head to head with any high-end tablet or low-end laptop.

But as far as I'm concerned this thing is for travelling. That's where it shines. It's gorgeously thin and light, has the best battery life of the whole Surface family and you can shove a SIM card into it for data roaming. Instant-on is great, too, if you need to regularly fire it up to do something quickly.

It's also a gem for mucking around and surfing while at home. Which is not to say that it can't handle proper workloads. It all depends on what you want your 2-in-1 to do. Be realistic. The Qualcomm CPU isn't an i7, but it's pretty capable. Nope, it doesn't run 64-bit apps, and for sure that rules out a tonne of stuff – but for a certain type that knows what they want from a machine the Pro X is a sexy, lightweight Windows-running computer. Spec it up with 16GB of memory and it won't choke.

The case against is cost. It *is* expensive compared to the Surface Pro 7, which can be had with similar storage and memory for nearly the same price. And, a much better CPU. And will run 64-bit apps.

If it's right for you, that's your balanced decision to make. I loved my time with the Pro X, but I have simple needs. I'd class this as a luxury item, for sure. Most people that vaguely suspect they might want to get heavy on workloads should buy a more powerful machine, even just to provide a performance safety net. And most people, it seems, think that way – I don't think Pro X sales are setting the world on fire, but I'm glad Microsoft made it, just like I'm glad Apple made the iPad Pro.

**BEN MANSILL**
**EDITOR**
**ben.mansill@futurenet.com**

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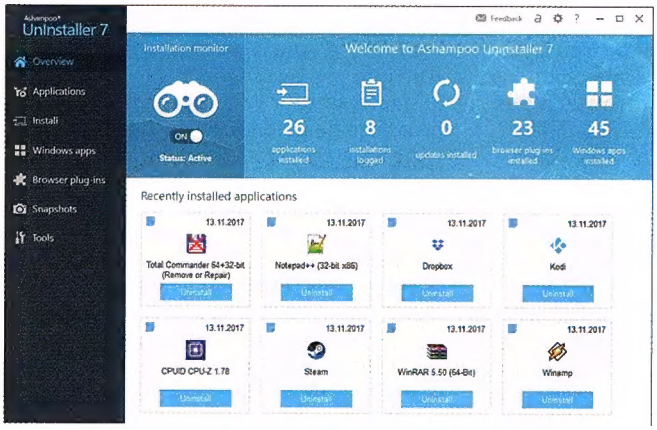

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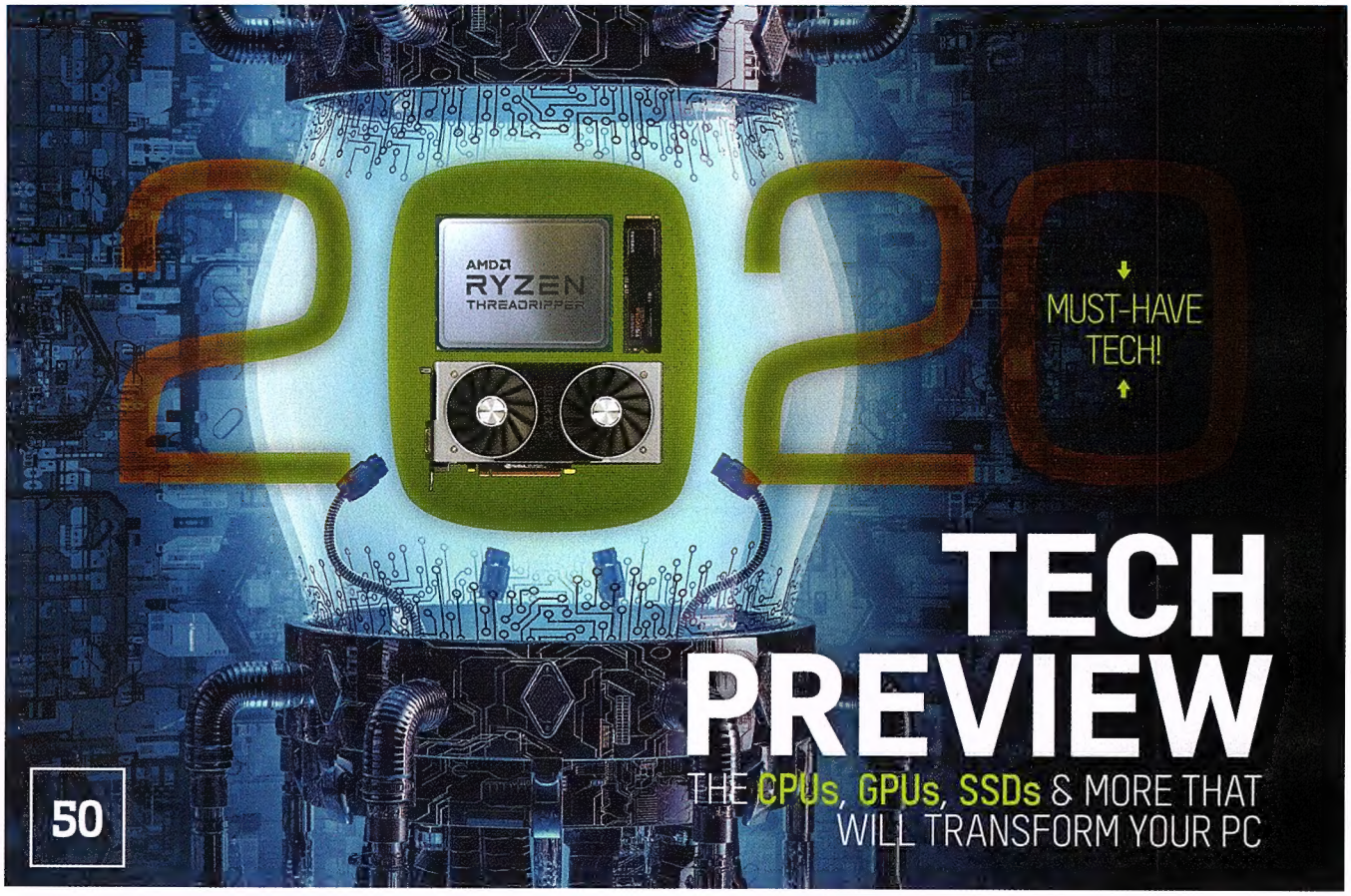

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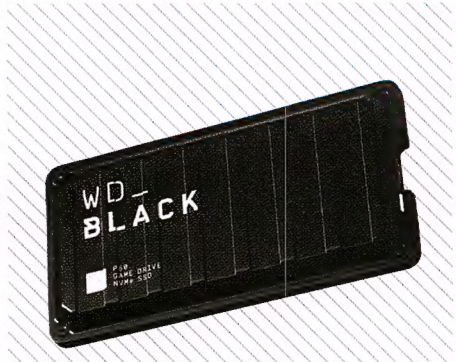


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Samsung C27RG5

# Inside APC

## Find out all about *APC*'s editorial policies, test practices, how to read the benchmark results, and more.

*APC* is Australia's oldest consumer technology magazine – having been consistently in print for over 35 years, since our first issue way back in May 1980 – and we take that heritage and responsibility very seriously. While our focus is obviously on the personal computer – it's in our name, after all – the very definition of the PC has changed and shifted markedly since the early 1980s. As such, we touch on many other areas of tech, too, from smartphones and apps to peripherals, accessories, online services and beyond. We have two main goals: to track down the best of modern tech and also to help our readers make the most of it.

We're also an open church in terms of platforms. We know most people aren't wed to a single brand's products and use a variety of devices. And, like you, *APC*'s journalists want to know what's good in tech – no matter what platform it resides on.

### INDEPENDENT REVIEWS

Championing technology doesn't mean we're unrelenting yes-men and -women, however, and *APC* aims to be as objective as possible in all our coverage. That means identifying the best products from multiple perspectives – the best performance, best value and best features and, ideally, the products that offer the best mix of these three.

As a matter of policy, reviews published in *APC* are not shared with product-makers prior to print. We will contact vendors under certain conditions; for example, if we have a problem testing a product that seems to indicate it may be faulty, or to invite a vendor to clarify how a particular feature works. If an *APC* reviewer has any potential conflicts of interest involving a brand, the review will always be assigned to another writer.

### LABS TESTING

Despite being a small magazine with limited resources, *APC* still strives to conduct the most rigorous, objective scientific tests and benchmarks we can so as to make our reviews as unbiased as possible. We use a variety of tools and programs for this, including many freely available benchmark suites for assessing media encoding, general system performance, gaming and battery life.

In most cases, for the benchmark results published in *APC*, you can assume that higher is better. There are certain tests that deviate from this rule where the opposite is true; in those cases, we've flagged the results with a note explaining as such.

We use both tables and graphs for displaying results; the latter are our preference due to their ease-of-readability, but tables are more compact, so we use these in cases where thoroughness is preferred.

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# technotes

» HARRY DOMANSKI & BEN MANSILL BRING YOU THE NEED-TO-KNOW TECH NEWS

IMAGE: SHUTTERSTOCK

## Raspberry Pi to get Vulkan graphics driver

OPEN-SOURCE CROSS-PLATFORM SUPPORT FOR THE SINGLE-BOARD COMPUTER.

Raspberry Pi, the popular single-board computers for makers, is getting an open-source version of the Vulkan graphics driver, The Raspberry Pi Foundation has announced. Vulkan is a cross-platform API that's supposed to enable improved graphics performance no matter what hardware it's running on. Companies like AMD, ARM, Intel and Nvidia have all released drivers that support the API; now the Raspberry Pi Foundation will follow in those companies' footsteps.

IMAGE: SHUTTERSTOCK

## Microsoft announces Xbox Live Bug Bounty

WITH PAYOUTS AS HIGH AS $20,000.

The company has invited "gamers, security researchers, and others around the world to help identify security vulnerabilities in the Xbox Live network and services and share them with the Xbox team." Microsoft will pay between US$500 and US$20,000 via the program based on the severity of a reported vulnerability. It's believed Microsoft is looking for high quality reports on critical vulnerabilities that enable remote code execution attacks.

## Intel Core i9-10900K listed with 5.1GHz Boost clock

THE NEXT-GEN 10-CORE FLAGSHIP CHIP HAS SHOWN UP IN 3DMARK.

The Intel Core i9-10900K is next in line to replace the i9-9900K. And as spotted by Twitter user @_rogame, it recently landed in the 3DMark database. Based on the Comet Lake microarchitecture, the i9-10900K could be the last flagship processor to come out of Intel's 14nm process node. The processor has 10 cores, 20 threads, and rumours point to a 20MB cache.

## Windows 7 is dead, but not enough people are moving to Windows 10

IT SEEMS POEPLE JUST LIKE THE OLD DOG.

After Windows 7 entered its End of Life phase on January 14, 2020, Microsoft was clearly hoping that people would ditch its old operating system and upgrade to Windows 10 en masse, and the latest report by NetMarketShare does suggest some movement – but perhaps not in the numbers Microsoft was banking on. The report shows a slight dip in Windows 7 market share, dropping from 29.57% from December to 25.60% in January, and Windows 10 has seen a proportionate increase, climbing from 53.36% to 57.08%. The fact that there was such a modest shift is a bit concerning for Microsoft, plus, as we move away from the date of Windows 7's End of Life, publicity around it will fade, which means we could see fewer people being persuaded to upgrade. And, while the number of Windows 7 users has dropped, there is still a huge number of people using the outdated OS. Windows 7 remains the second most used operating system, after Windows 10.

## Beware of what you're opting into when installing free antivirus software

AVAST IS UNDER SCRUTINY FOR HARVESTING AND SELLING OPT-IN BROWSING DATA.

Avast is a name that inevitably comes up when discussing free antivirus software, and with good reason – the company claims it has over 435 million users. Avast's reputation is under fire, however, following a joint investigation by *Motherboard* and *PCMag* into the extent it sells opt-in user data to third parties.

According to the reports, leaked documents highlight the "secretive sale" of internet browsing histories and activities to a subsidiary called Jumpshot. That information is then packaged and sold, with Google, Yelp, Microsoft, Pepsi, Home Depot, and others among some of the bigger past, present, and potential clients. In some cases, clients paid millions of dollars for an "all clicks feed," which includes website tracking data, clicks, and detailed accounts of movement across sites, according to the report.

This only happens when users who install the free antivirus software opt into having their data collected. *Motherboard* says it viewed data that included Google searches, GPS coordinates, people visiting LinkedIn pages, YouTube histories, and porn site visits.

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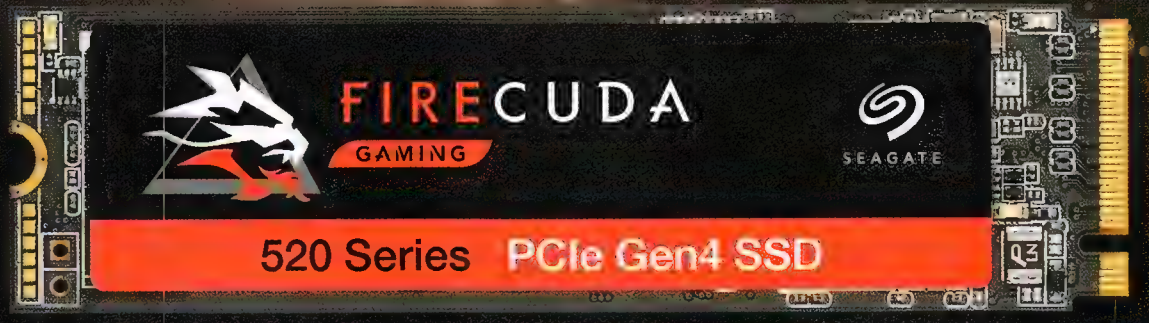


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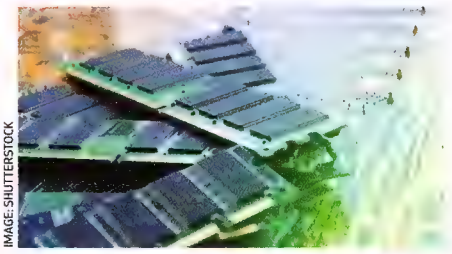

IMAGE: SHUTTERSTOCK

## Adata expects memory prices to rise after coronavirus is contained

NAND AND DRAM PRICES WILL RISE BY JUNE IF THE OUTBREAK IS MANAGED.

Adata's Chairman Simon Chen hopes that growing demand for memory products will resume by June if the latest health scare is contained. That's despite concerns about Coronavirus impacting Q1 demand. According to *DigiTimes*, Chen said that although he expects the outbreak to hurt Q1 numbers for physical retailers, large growth from online retailers will drive higher prices. NAND prices have climbed 30-40% since Q4 2019, *DigiTimes* said.

## VMware's new licensing fees will hurt AMD's 64-core Epyc

YOU'LL PAY TWICE AS MUCH IF YOU HAVE MORE THAN 32 CORES.

VMware has doubled the price of licensing the company's software for CPUs that have more than 32 cores. The new move applies to all of VMWare's software, and given that the Dell-owned company holds 75% of the server virtualisation market, the change will have a far-ranging impact on data center processors with high core counts, like AMD's EPYC Rome. Intel will also be impacted when its processors move to 56-core Cooper Lake models.

## Nvidia GeForce Now will let you play ray traced games on a MacBook Air

IN AUSTRALIA, IT'S MORE LIKE GEFORCE SOON, THOUGH.

Although not yet available in Australia, Nvidia's GeForce Now game-streaming platform recently landed in other global markets. It's the first service that allows you to stream your own games from Steam, Epic and other services, and play them with ray tracing and at a locked 60fps. What that means is you'll be able to stream games on their highest settings on relatively low-powered hardware.

# Gaming Chromebooks might finally be on their way, according to leak

THE NEW WORST GAMING PLATFORM.

A leaked Chromebook spotted by Chrome Unboxed and codenamed "Mushu" may fall into Intel's Project Athena program, and it seems that device includes its own dedicated graphics processor. It's not clear at present which chipmaker is behind the GPU, although AMD and Nvidia are obviously the likely candidates. This would be a first for Chromebooks, and could deliver a new level of performance that the form factor has yet to see – particularly when it comes to gaming. Existing Chromebooks, even on the premium end of the spectrum, will only be able to handle running a small number of games from the already reduced library of Steam games readily supported on Linux. That equation will change with a dedicated graphics processor. And, depending on how well Valve and Google get Steam and its library working on ChromeOS, we could be looking at our first gaming Chromebook this year. We hardly expect it will be anything close to the best gaming laptops, though.

# Google will get faster at releasing Chrome security patches

CHROME SECURITY TEAM CUTS CHROME'S PATCH GAP BY HALF.

Google Chrome will soon start receiving security updates more quickly as security engineers at Google have successfully cut down the browser's "patch gap" from 33 days to just 15 days. The term patch gap refers to the amount of time it takes from when a vulnerability is fixed in an open source library to when it is patched in software which uses that same library. Patch gaps are considered a major security risk as many software applications rely on the same open source components. Once a security bug is fixed in an open source library, details about the bug become public as most open source projects are public and pride themselves on transparency. However, by revealing these details, hackers can then use them to craft exploits and launch attacks against software that has not yet been patched. Many software makers, such as Google and even Microsoft, use a fixed release schedule to update their products, creating a gap that hackers can leverage to provide themselves with an attack window that most software projects will have a hard time defending against.

AORUS
2K QHD
165Hz
HBR III
10bits
NEW AORUS MONITOR LINEUP HAS LANDED!
FI27Q & FI27Q-P
HBR3 allows you to enjoy 2K, 165Hz, HDR, 10 bits color AT THE SAME TIME
2.0 ANC
2.0 BLACK EQUALIZER
NVIDIA G-SYNC
AMD FREESYNC TECHNOLOGY
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GIGABYTE

# Open-Source Smart Home

## Major players join forces to get into your home.

Amazon, Apple, Google, and the ZigBee Alliance have joined up to form Project Connected Home over IP (CHIP), with the aim of developing a framework for the integrated smart home. The ZigBee Alliance was formed in 2002; its main work until now was to look after the ZigBee standard of low-power radio and personal area networks – the kind of gear the smart home needs (the name is from the dance honeybees do when returning to the hive, if you were wondering).

This new organisation has a simple enough goal: to produce a standard open-source, royalty-free, certified internet protocol for the smart home. There is a mess of standards at the moment – most gear uses a proprietary system, and so is tethered to a home network using dedicated proxies and translators. The plan is that ultimately you'll be able to use almost any devices seamlessly; your smart speaker will work with all your other smart devices, from the lighting to the security alarms, heating, and so forth, regardless of who made them.

The new protocol won't replace existing standards – this is no Wi-Fi or Ethernet rival – but rather it will work alongside existing protocols to make sure they co-operate at a fundamental level. It won't standardise user interfaces or suchlike, only the communication between devices. It will initially concentrate on Amazon's Alexa Smart Home, Google's Weave, Apple's HomeKit, and ZigBee's Dotdot. The organisation's webpage gives little away; it doesn't even appear to have a logo yet. It says that "the project is built around a shared belief that smart home devices should be secure, reliable, and seamless to use." It stresses the security aspect, claiming it is a "fundamental design tenet" of the new standards. Given the number of recent breaches, that's comforting.

Good news? Yes. The current patchwork of systems is frustrating, and a standard is an obvious step forward. It won't matter which smart speaker you buy, they should all work. The smart home is a huge growth area. The smart speaker market has grown from just under 114 million units sold in 2018, to over 205 million last year, and is still growing rapidly. Smart lighting was worth a little under $11.5 billion in 2018, and is predicted to grow at over 20 percent a year. It's a similar story with other sectors; every graph shows a strong upward curve.

The Internet of Things is arriving quickly. Now we have an organisation to ensure co-operation, it's a wonder we didn't have one earlier. Initially, the winners are likely to be Amazon and Google. Apple has a few hundred devices for its HomeKit; Google has over 10,000 smart home compatible devices; Amazon has over 80,000.

It's easy to be cynical, so let's do that: Big companies only co-operate when they think the outcome, and therefore profits, will be better. Witness Apple and Qualcomm. The two were at each other's throats over 5G patents, with billion-dollar lawsuits flying about. The spat lasted over a year, and must have consumed a fortune in lawyer's fees. Then, suddenly, peace reigned. The two shook hands, and settled everything remarkably quickly. Why? Because Apple needed the 5G chips as Intel pulled out of the market, and Qualcomm wanted a big customer. Amazon and Google are not exactly good friends, but commercial reality trumps everything.

The goal of CHIP is to help the growth of the smart home market, and fragmentation doesn't help anybody. Last year, 530 million smart home devices were shipped; it has been estimated that the figure will rise to 1.6 billion by 2024, so there will be plenty of pie to go around. As well as making money from selling hardware and subscriptions, the smart home market is going to be a data-collecting gold mine; marketing data is valuable stuff, witness the profits Facebook has made. That's a whole different issue, though...

The first draft of the Project CHIP standard is due before the end of the year. It is expected to concentrate on Wi-Fi, up to Wi-Fi 6, and Bluetooth Low Energy. Ethernet and cellular specifications will follow that. In a few years, the majority of smart home gear will be fully compatible with the new standard, and we'll have half-forgotten that there was a time when it wasn't so. ■

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# gadgets

» GIZMOS AND GOODIES.

## INSTA360 ONE R

A moddable 360 action camera that can be a straight shooter if you want.

**$750 | INSTA360.COM**

Insta360's new One R is an appealing proposition for anyone looking to get into 360 video, since it works well as both a regular 4K action camera and a 360 degree shooter. It does this by having separate lens and battery modules that can be swapped out for different 2D or 3D video capture. The Insta360 One R comes with water resistance to five meters and includes a new screen that is small, but can be flipped to face you while shooting. In 2D the One R can shoot up to 4K 60fps and for 360 degree shots you'll get a pre-stitched 5.7K spherical video that you can import and edit on your smartphone.

## PLATYBALL

This tripod accessory is a ballr.

**FROM US$219 | KCK.ST/3001JTS**

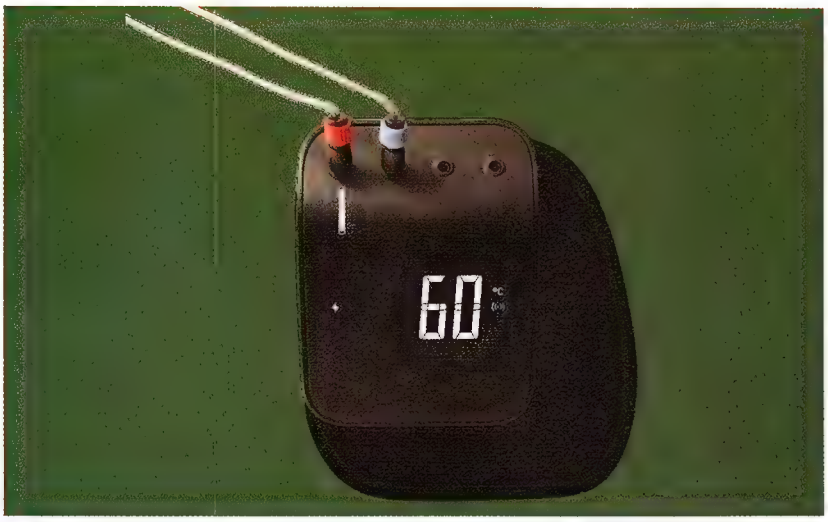
You might think the camera tripod is a finely tuned beast that can't really be improved anymore, but the team behind the new Platyball Kickstarter are here to show you what you're missing out on. The rough idea is that the system inverts the panning movement to the top of the attachment so you can get smooth single axis rotation for any panning shots. It's also got a built in digital leveling indicator that is precise and easy to see and there are two other button-accessible tilt controls that can easily be manipulated using one hand.

## OSPREY TROPOS

A big daily backpack that's actually got your back.

**$169.95 | OSPREY.COM**

While most of us could make do with any kind of backpack, if you carry around a large gaming laptop, or just a lot of tech, then it might be worth considering a little extra support. The Tropos from Osprey is designed to distribute its weight evenly across your shoulders and lumbar using eight adjustable straps and a suspension mesh. This support system makes carrying heavy loads less taxing and means your contact points get less hot and sweaty on long trips. The 17-inch laptop sleeve is seperate from the generous main compartment and the 34L backpack has ample organisation pockets and a convenient scratch proof sunnies/ smartphone section.




## WEBBER CONNECT

A BBQ thermometer that's 'well done'.

**US$130 | WEBBER.COM**

While a great many people are likely to say that they already know how to perfectly cook meat on the barbie, when you've got a house full of guests and are prone to distraction, having a safety net to prevent you from over-cooking your dinner is a comforting piece of tech. The Webber Connect is a smart thermometer that plugs into your meat and then connects to your phone over Wi-Fi, so you can leave your flame-side post without anyone feeling as though they need to step in and save your rump.

## NEST WIFI

Google's mesh Wi-Fi system returns to roost.

**FROM $229 | STORE.GOOGLE.COM**

For anyone wanting a superior full home Wi-Fi network without having to invest in multiple big antenna-clad routers then Google's mesh Wi-Fi system provides an easy, sleek solution to a deadzone-free wireless network. On the network front the Nest Wifi offers similar features to the original Google Wifi system, the Nest access points now act as smart speakers allowing you to streamline your smart home setup and make sure there's coverage wherever you need it. Nest brings across the best network management features, offers simultaneous connections for up to 100 devices and can manage local throughput speeds of over 100MB/s. Not bad for a smart speaker.

## ARCADIO GAMING HAPTIC CHAIR

Shaking up the gaming chair market.

**$TBC | ARCADEO.COM**

Considering that RGB LED lights adorn just about every inch of today's gaming PC peripherals, it's surprising it's taken this long to make the jump to a gaming chair. The Arcadio Gaming connected chair finally bridges the gap by stitching an RGB lighting strip into the headrest and syncing it with your PC lighting software to colour the edges of your vision in a halo of LED light. If that wasn't enough, the connected chair also claims to provide haptic feedback for media and games, in the hope of shaking you into a more immersive experience. ■

# The AMD Radeon RX 5600 XT launch scandal

## A mountain or a molehill?

If you've already flicked through this issue, you may have seen our Radeon RX 5600 XT review on page 34. It's a good card, and it's very competitive in its price range. You might also have heard how AMD released a BIOS update just prior to the launch in order to boost performance. From a reviewer's point of view, this kind of last minute change is not ideal, but what matters is how such a change is received by end users. Some reviewers decided to really blast AMD for the late change, something I feel was overblown. As the reviewer of the card for *APC*, I wasn't thrilled with the late change but my concerns were based around how such changes appear to the public. Is it AMD being shady? Or is it nothing more than a pre-launch change akin to a motherboard-maker releasing an updated pre-launch BIOS? In my opinion, it's the latter.

In the days prior to the launch of the RX 5600 XT, Nvidia made the decision to drop the price of its RTX 2060 card in order to better align it competitively against the as-then-configured 5600 XT. It may appear as though AMD was surprised by Nvidia's move, but it's important to note that validating a BIOS to work across entire product stacks is not the sort of thing you do overnight, so AMD was likely rush testing the 5600 XT with higher frequencies well before the launch.

The 5600 XT uses a cut down version of the Navi 10 GPU that's found in the RX 5700 and 5700 XT. Obviously AMD doesn't want the 5600 XT to cannibalise the 5700's sales, but at the same time it doesn't want to sacrifice its likely thin profit margins. So faced with two options – dropping the price, or tapping into some of the known headroom of the Navi 10 GPU, it chose the latter. Providing free performance is a win for end users, after all.

AMD's worst offence here is how it looks to those end users, especially those that aren't tech savvy. Someone looking for a new GPU might Google '5600 review' and see stories from prominent tech media lambasting the BIOS update. Will the user know which BIOS they have? Would they even be familiar with a utility like GPU-Z, let alone have the knowledge and confidence to flash a BIOS? Further to this, AMD and its partners state that only the very first batches of cards have the old BIOS, so any card bought in the future will have the new BIOS already. AMD has created a long term headache for itself, but little more than that.

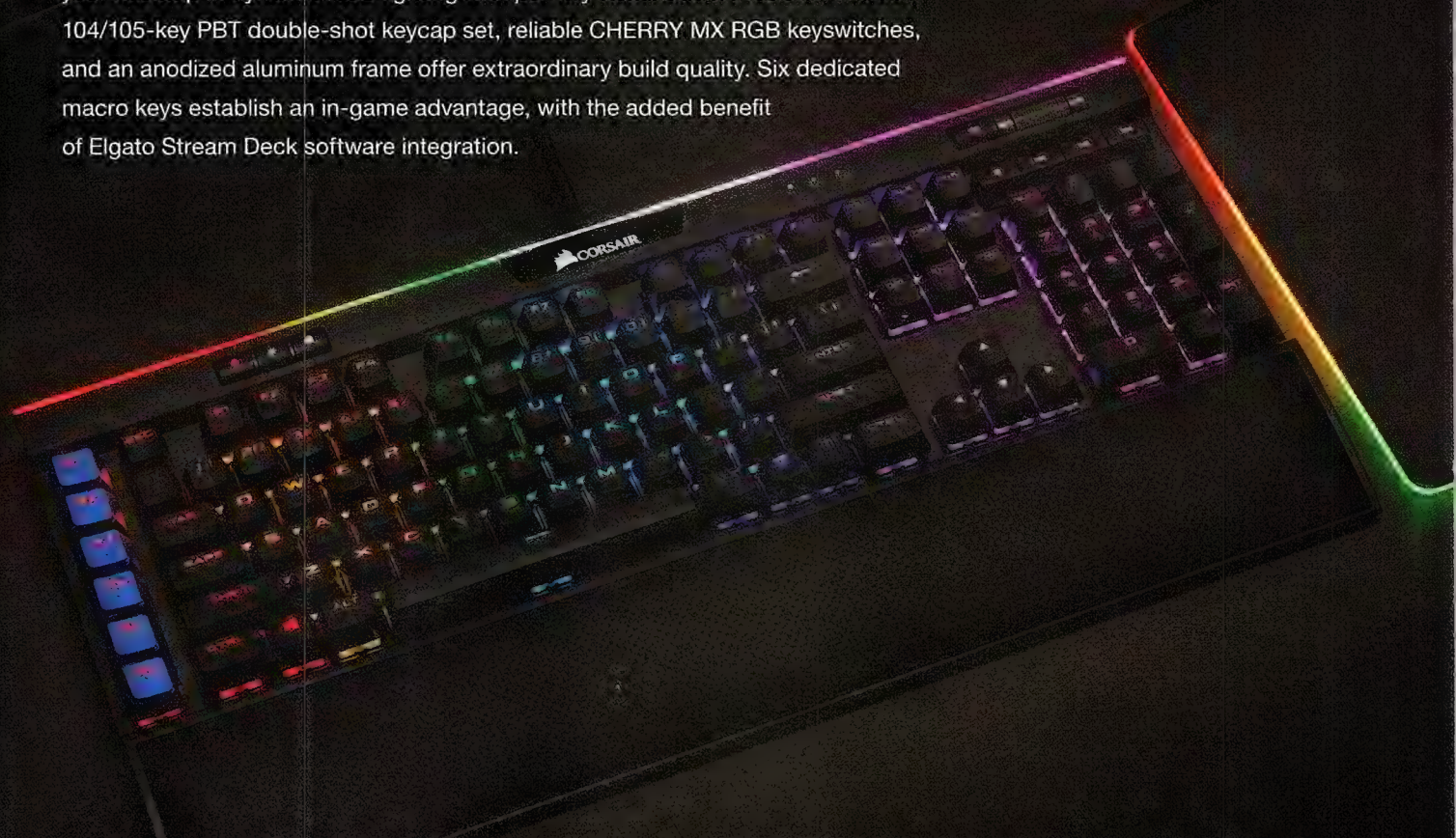
In summary, any 'controversy' relating to the launch of the RX 5600 XT is pretty much a storm in a teacup. AMD did score something of an own goal with questions about what card has what BIOS over the life of the product. Having said that, some reviewers need to take a hard look at themselves. Instead of thinking of their own perceived woes, they need to remember that they're providing a service to the public. They're there to provide unbiased information and analysis to readers and viewers and not focus on a very temporary, perceived sleight. AMD could have handled things better, but by gosh, let's not make a mountain out of a molehill. ■

"AMD has created a long term headache for itself, but little more than that."

CORSAIR

# PLAY WITH A FULL DECK

The CORSAIR K95 RGB PLATINUM XT Mechanical Gaming Keyboard immerses your desktop in dynamic RGB lighting with per-key illumination. Precision-molded 104/105-key PBT double-shot keycap set, reliable CHERRY MX RGB keyswitches, and an anodized aluminum frame offer extraordinary build quality. Six dedicated macro keys establish an in-game advantage, with the added benefit of Elgato Stream Deck software integration.




# K95 RGB PLATINUM XT

Mechanical Gaming Keyboard

MX CHERRY CUE

# The unbearable convenience of Google and Facebook

Not even a deep-seated antipathy for tech giants can ween you off them, Shaun Prescott writes.

Not long ago I stumbled across Google Photos in my web browser. When I dared click on it, what unfolded was an archive of thousands of my smartphone photos – all 'online' and not, as I had thought, secured on my smartphone. My initial shock soon gave way to a kind of fatefulness – I must have volunteered to use Google Photos at some point in the past, whether deliberately or otherwise. And yet, I couldn't remember when. Given my general antipathy towards cloud services, and especially Google cloud services, I couldn't imagine ever willingly sending pictures of my kids into the clutches of Google. And yet...

Google Photos is a cloud service that, once opted into (whether deliberately or not!), will automatically pull smartphone photos into the cloud. The benefit of Photos over Drive or Dropbox is that you can immediately view these photos at any time from any machine, providing you're logged into your Google account. And the presentation is actually pretty cool: you can search by several default categories including People, Pets and Things, with Google's facial recognition tech able to determine who is in the photo (with a little bit of your help, if you happen to have grown a beard and then shaved it off at any point). These photos are private by default, but can be shared with other Google account holders. The service also automatically creates collages and photo sets, and incessantly reminds you to look at them.

So it's a pretty irresistible feature, in other words, which somewhat allayed my anxieties about forgetting that I'd even opted into it. That's how Google gets you: it offers free, immensely useful software that becomes embedded in your life, then it profits from it in mysterious ways, buried in T&C documents of Tolstoy-like proportions. And besides, we tell ourselves, Google is one of the biggest tech companies in the world – surely a data breach is impossible?

Well, that depends. Last month, in an email advising select users about a technical issue with Google Photos, the company quietly confided that some Google Photos videos were being "exported to unrelated users' archives". In other words, the videos were appearing in other people's accounts. This happened during a brief period of time – November 21 and 25 last year, specifically – but if you've any misgivings about using Google Photos, this will likely ring alarm bells.

It did for me, and yet, last week, having acquired a new smartphone, I was faced with the question of what to do with all my photos. My old phone was so incapacitated that manually dragging them onto a hard drive or desktop wasn't an option. But then I remembered: It doesn't matter! Google has been pilfering my photos this whole time.

I don't like giving my personal information or memories to Google, any more than I like to have anything to do with Facebook. But during the bushfire crisis last month, being a Blue Mountains resident, I signed up in order to join some community watch groups. What I found was enormously impressive: a handful of round-the-clock unpaid moderators fighting an uphill battle against Facebook's woeful display algorithms, fighting unpredictable forces in order to make sure people saw up-to-date information first. It's an objectively terrible platform, and yet everyone is using it – it hosts the kind of interaction and information you can't get anywhere else. So I'm back on Facebook again, and I hate it, and yet... what other option do I (do we) have, short of armed insurrection, or, uh, everyone moving to a better platform? ■

## Share your stories!

If you have an interesting story about technology users, their experiences and the issues that affect us all (whether funny or serious), email us at **apcmag@futurenet.com**. All correspondence becomes the property of *APC* and is subject to editing. Letters must include writer's full name, street address, suburb, state and phone number to be considered for print publication. Address and phone details will not be published.

» JOEL BURGESS STEPS INTO THE FRAY.

# Facebook doesn't care what you think about it anymore

## Did this social media giant just realise that it is now too big to fail, and what does that mean for the future of democracy?

In the first days of 2020, following the death of Iranian military commander General Qassem Solemani in an airstrike near Bhagdad, it became obvious that Donald Trump's campaign was working closely with Facebook to manage the narrative around the assassination. In addition to running 590 new advertisements to praise the President's actions regarding the airstrike, Facebook also seemingly helped promote Trump's native content, with the POTUS taking out the top five spots for the most interacted with content containing the word 'Iran' on the site.

With a collective total of 4.1 million interactions, the President's direct commentary on the event overshadowed all the major news outlet's posts on the situation, meaning that Trump's unvetted words were the primary source of information for large portions of the population. While this might not seem remarkable, it is the first time a President's direct message has clearly overshadowed the reach of established media outlet's impartial, fact-checked editorial on nuanced international topics.

Later in January it emerged that Facebook had settled a class action lawsuit in Illinois to the tune of US$550 million dollars ahead of its quarterly shareholder report. The suit claimed that Facebook violated the state's Biometric Information Privacy Act by storing facial images and using facial recognition technology to label them for its 'Tag Suggestions' function. In addition to not seeking participants consent, the suit claimed Facebook failed to inform subjects of how long their facial data would be kept. Facebook denies any wrongdoing, but even if it is just a tiny fraction of Facebook's annual profits, half a billion dollars is a considerable settlement for an innocent company to swallow.

If that wasn't enough, before the month could come to a close *Gizmodo* found that Tinder was sharing sensitive data with third party companies including Facebook after investigating the privacy policy of a new Panic Button feature. Late in 2019, *ProPublica*, *BuzzFeed* and *Coloumbia Journalism* investigations revealed that dating apps were involved in 150 sexual assault cases with as many as 10% occuring form matches with people who had already been convicted or formally accused of sexual assault charges. The Panic Button feature was intended to be a step to reduce sexual assault vulnerability and could be added to Tinder by signing up to the free affiliate app Noonlight, which would share location data and other information with third party marketing sites, including Facebook.

Considering this rather colourful January it's perhaps not overly surprising that Mark Zuckerberg took the company's quarterly earnings report as an opportunity to announce that Facebook no longer cares if you like it. "'My goal for the next decade isn't to be liked, but to be understood" said Zuckerberg in the shareholder meeting... elaborating a few days later at a tech summit that "This is the new approach, and I think it's going to piss off a lot of people". For a company that built itself on the social currency of 'Likes' it's interesting that it's now powerful enough to diverge so heavily from them.

Zuckerberg did take the time to spell out exactly what we are going to dislike moving forward. Facebook plans to continue to run political ads it knows contain proven falsehoods, it'll support the existence and amplification of outrageous and corrosive messages by fringe groups, it'll continue to safeguard its monopoly on data by advocating privacy and encryption messages when convenient, it'll divert any responsibility for its role in creating a surveillance state by advocating the business benefits of targeted marketing and it'll continue to belittle the value of what people give up when they sign up to Facebook. ■

# numbercrunch

» WE LOOK AT THE NUMBERS DRIVING THE BIG TECH NEWS.

## 1,482 DAYS

Was the lifespan of Windows 10 Mobile, released to manufacturing in November 2015, and officially reaching end of support on December 10 2019. Available on Lumia phones and a few obscure devices from the likes of Wileyfox, Win 10 Mobile couldn't compete with Android or iOS, and Microsoft stopped active development in October 2017.

## 2004

Seems to be the number of the next version of Windows 10, the build previously known as 20H1, with both the fast and slow rings of the Insider programme currently testing it.

## 64

The number of qubits in Google's Sycamore quantum computer, with which it has claimed quantum supremacy – carrying out a mathematical process in 200 seconds that would have taken a classical computer 10,000 years.

## 100KG

The weight of the space junk being targeted by the ESA's ClearSpace-1 mission to remove space junk from orbit around Earth. The object, the remains of a rocket's upper stage, is considered representative of much of the debris around our planet, and if successful the four-armed satellite could go on to capture more astro-rubbish after its launch in 2025.

## G3420

An ancient, in CPU terms, Pentium processor from the Haswell days seems to be back on the manufacturing block at Intel. The 22nm chip, which was originally released in Q3 2013, is most likely aimed at the embedded processor market after Intel recently apologised for not making enough of its contemporary chips available.

## JANUARY 15

Was a big day for those remaining Windows 7 users out there: the venerable OS started showing fullscreen popups to hammer home the message that it is no longer supported by Microsoft.

# howit'sdone

Apple has redesigned its notorious butterfly switches for this new laptop.

After taking apart the keyboard, it's time to de-lid the main unit.

## MacBook Pro 16-inch

### What's new inside the new Macbook Pro?

A beloved old feature returns to the MacBook Pro: It starts with M-a-g. If you guessed MagSafe, we have disappointing news, but if you said "Magic Keyboard," we have the teardown for you. It's the all-new, butterfly-less, 16-inch MacBook Pro, and we're here to turn it inside-out.

**MAJOR TECH SPECS**

- 16-inch LED-backlit IPS Retina display with True Tone, 3072x1920 resolution (226 ppi)
- 2.6GHz six-core Intel Core i7 and AMD Radeon Pro 5300M
- 16GB of 2,666MHz DDR4 SDRAM, plus 512GB SSD
- 100Wh battery, six-speaker sound system, and high-performance microphone array

**KEY FINDINGS**

- Remember the iMac's Magic Keyboard? It's a well-liked, reliable design that Apple calls the "core technology" for the redesigned keyboard in this new machine; side by side, we're hard-pressed to spot any differences. Scissor switches, keycaps... there's slightly less space around the keys, and pundits will celebrate those reconfigured arrow keys.
- Now let's look inside. Torx screws, schmorx screws – our Marlin driver set does it all. Apple touts major advances in this MacBook Pro's thermal design, and says this heatsink is 35 percent bigger. We also found upgraded hardware covering what we presume to be fast new GDDR6 chips – a copper shield and a couple of aluminum thermal pads.
- With the motherboard out of the way, we can take a peek at the rest of the improved thermal design. The new MacBook Pro has noticeably larger exhaust holes than the 15-inch 2019 model. Combined with the new fans, which have bigger impeller blades, it all pushes 28 percent more air through the new Pro, allegedly allowing it to sustain up to 12W more during intensive workloads.
- The keyboard backlight assembly consists of a flexible diffuser, which carries light from LEDs along the edges. Beneath, we spot some Pentalobe P2 screws along the edges of the metal keyboard frame. Can we unscrew it to swap a busted key after a Dorito-fueled type-a-thon? No! Again, the keyboard assembly is riveted down. Although the switches are likely less vulnerable to crumbs, the keyboard isn't any more repairable than a Butterfly board.
- The new speakers have an extended enclosure, and opposed woofers top and bottom, which are supposed to cancel each other's vibration out. Kinda like the anti-noise feature of the new AirPods Pro, but with bass. Anti-bass? We aren't as sure about the elongated enclosure, but we guess the new shape redirects sound to improve quality.
- Finally, the lithium powerhouse that's probably drawing a suspicious glare from the FAA: Apple's 99.8Wh battery (11.36V, 8,790mAh). That's the largest we've ever seen in a MacBook – a 4.8Wh increase over the 17-inch MacBook Pro, and a 16.2Wh increase over the latest 15-incher.
- Repairability Score: 1 out of 10 (10 is easiest to repair). The trackpad can still be replaced with very little drama. Minor components are modular, but the CPU, RAM, and flash memory are soldered to the logic board. Glue and/or rivets secure the keyboard, battery, speakers, and Touch Bar, so are a tricky fix. The Touch ID sensor is the power switch and is locked to the logic board, complicating repairs. ■

# Threadripper 3970X vs. Core i9-10980XE vs. Ryzen 9 3950X

## Battle of the big chips.

**Last month we looked at affordable APUs; this time, we're going in the opposite direction, and pitting the biggest and baddest CPUs around against each other. These are the high-end desktop parts, the big boys, the costly but high-powered processors that many of us will never even hold in our hands. These CPUs have more cores, higher clock speeds, and monstrous power draws compared to your average desktop processor, making short work of CPU-heavy tasks and benchmarks. But which one is best? Let's take a look.**

1

### Value

Which of these HEDT processors is the best value? Well, it's not the new Threadripper. Yes, the 3970X has some entertainingly over-the-top specs and tends to top most benchmarking tables, but if you thought the second-gen Threadrippers were pricey, the 3980X commands a healthy $3,199. The other two processors are pretty close in price, with the Ryzen 9 3950X costing $1,219, and the Core i9-10980XE coming in at $1,799.

In terms of value for money, they're pretty close, too. The 10980XE is 16 percent more expensive, but it does have 12 percent more cores (that's 18 cores compared to the Ryzen's 16). The 3950X's cores are tad faster, though, with a core clock of 3.5GHz as opposed to the 10980XE's 3.0GHz. It's a close call, and none of these CPUs comes with an included cooler to tip the balance of value; the assumption is that if you can afford one of these chips, you can afford a powerful third-party cooling solution.

Ultimately, we'll give it to the 3950X, because it's the cheapest of the three, yet can still outperform the Intel chip in some areas. The Ryzen CPU still comes with a free game and three months' worth of Xbox Game Pass for PC at the time of writing, too.

**WINNER: RYZEN 9 3950X**

2

### Efficiency

Again, the Threadripper stumbles out of the gate and has to be put down. Tragic. Yes, that monstrous 280W thermal power design means that the 3970X is out of the running, as it guzzles power to ensure that top-tier performance. The Threadripper series has always demanded serious cooling, too, requiring a specific TR4-compatible cooling block.

The Ryzen 9 3950X has a relatively conservative TDP of 105W; still pretty high for a conventional desktop CPU, but sensible for an HEDT part. There's nothing particularly notable efficiency-wise here, but none of these CPUs is very efficient, all demanding a lot of power and producing a lot of heat, particularly if overclocked. The i9-10980XE draws 165W, and uses the more esoteric LGA 2066 socket in terms of cooling, unlike the 3950X, which uses the common AM4 socket.

In short, the Ryzen is the winner again here. The 3950X isn't amazingly efficient by any means, but it's certainly the best in this limited field, almost purely by virtue of its comparatively low power draw. It's relatively overclockable, but doing so brings its thermals up into the range of the other two CPUs, so this is a close one, but we'll give it to the Ryzen.

**WINNER: RYZEN 9 3950X**

3

### Features

The Intel CPU isn't looking good in this section. There's a handful of features unique to each of these processors, but both AMD chips have something that the 10980XE lacks: PCIe 4.0 support. Intel has yet to break into the fourth generation of PCIe devices, which brings support for super-speedy NVMe Gen 4 M.2 SSDs, and improved bandwidth for expansion components, such as GPUs. Specialist systems, such as home RAID setups, benefit significantly from the improved read/write headroom PCIe 4.0 offers, and anyone who deals with large file transfers on the regular should see an improvement, too. Both AMD chips utilise PCIe 4.0 for core interfacing, improving internal speeds.

PCIe 4.0 is the big draw, but there are other features of note. Intel's Turbo Boost tech means that the 10980XE is theoretically capable of some seriously impressive automatic overclocking figures on a per-core basis – useful, as manual overclocking isn't something you'd want to do with these CPUs. The 10980XE and 3970X have quad-channel memory support, while the Ryzen 9 CPU only has dual-channel support. That leads us to look to the Threadripper for our winner this round, with PCIe 4.0 and quad-channel memory making it the most feature-packed chip on the list.

**WINNER: THREADRIPPER 3970X**

3

## Performance

Yes, all right, you guessed it: The Threadripper wins this round. Thirty-two cores and sixty-four threads make for an insurmountable foe, and the 3970X dominates in almost every area. The 10980XE is able to eke out a few minor victories in specific areas (it handles singlethreaded performance slightly better in a few tests), and it does provide superior performance in most games, but only by a very small margin; those frame rates are far more dependent on the GPU being used, and it's easy to hit a point of diminishing returns, because the Intel Core i9-9900KS actually beats the 10980XE in most games. More than eight or twelve cores doesn't benefit you much in gaming terms, with the 3950X actually beating its big brother, the 3970X, in some titles.

The 3950X might be the cheapest chip, but it's a surprisingly scrappy contender here. It can't match up to the core-packed power of the 3970X, but it does manage to beat the 10980XE in some areas, thanks to fast multithreaded performance. Using AMD's Ryzen Master utility software to tweak CPU performance for different tasks (such as using the Game Mode and Creator Mode options for the relevant purposes) can make a noticeable difference for both AMD processors. In the end, though, the numbers speak for themselves: Tonnes of cache memory and cores make the Threadripper our victor.

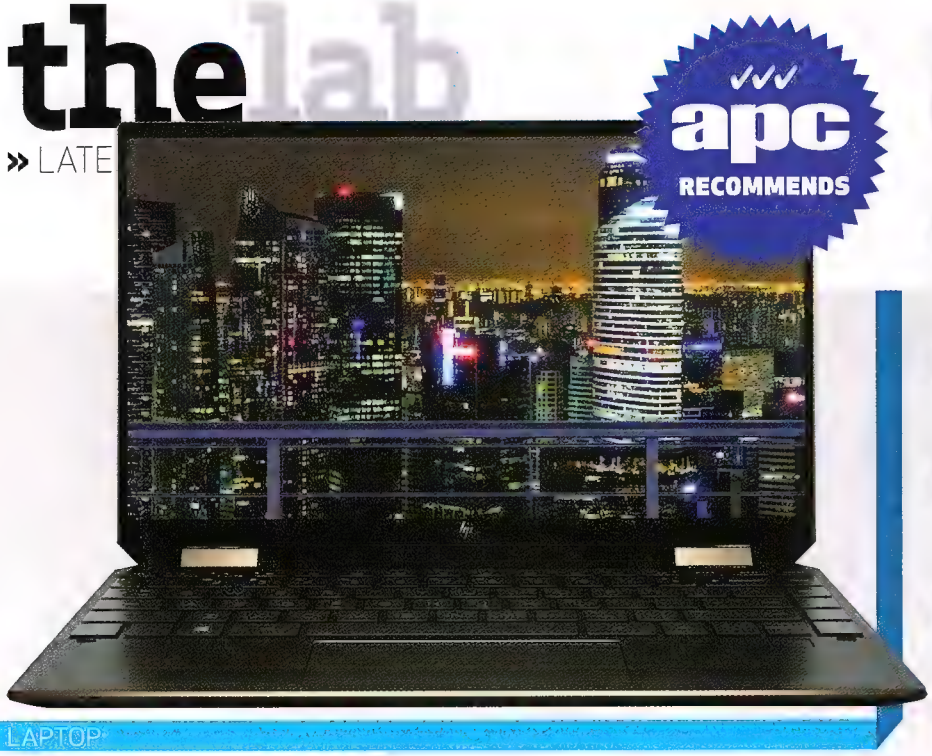
| | THREADRIPPER 3970X | INTEL CORE I9-10980XE | AMD RYZEN 9 3950X |
|---|---|---|---|
| CINEBENCH R15 MULTITHREADED (FPS) | 7,573 | 3,799 | 3,992 |
| CINEBENCH R15 SINGLETHREADED (INDEX) | 210 | 204 | 213 |
| POV-RAY 3.7.1 (PPS) | 14,754 | 9,379 | 8,334 |
| H.264 HANDBRAKE (FPS) | 208 | 153 | 156 |
| 7-ZIP BENCHMARK COMPRESS (MIPS) | 160,626 | 124,447 | 87,628 |
| 7-ZIP BENCHMARK DECOMPRESS (MIPS) | 345,801 | 153,650 | 179,138 |
| VERACRYPT AES (MB/S) | 19,650 | 25,100 | 10,300 |

**WINNER: THREADRIPPER 3970X**

## And the winner is...

The best CPU in this selection is the Threadripper 3970X. There's no doubt about that; this 32-core beast wins in almost every area of testing, and has the raw processing power to outmatch the other two. The 3970X is awesome in every sense of the word, but it's fair to say that it isn't a realistic prospect for most consumers. Pricing a single component at $3,200 isn't really going to entice anyone outside the prosumer space, and while the other two processors aren't exactly affordable, there's more potential for enthusiasts there.

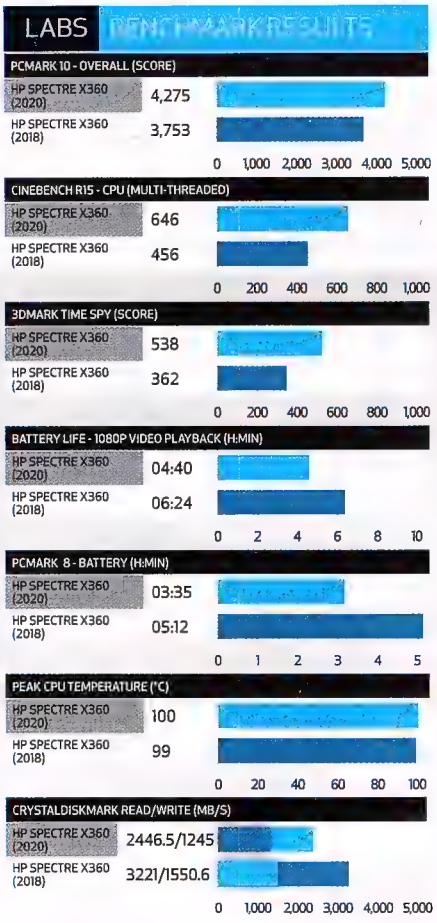
Unless you're carrying out very specific tasks (such as disk encryption, in the vein of the VeraCrypt benchmark), we would find it difficult to recommend the Intel Core i9-10980XE. Yes, it's the best in most game benchmarks when coupled with a 2080 Ti, but only by a few frames per second, and we really can't stress enough that you should not be looking at any of these components to build a pure gaming system. HEDT parts are best put to use in computers that will be carrying out CPU-intensive tasks, and we'd recommend close runner-up the Ryzen 9 3950X for any enthusiasts reading this. $1,200 is a lot for a CPU, but the 3950X is a high-quality component that will provide top-notch processor performance. ■



apc RECOMMENDS

LAPTOP

**$2,999 | WWW2.HP.COM**


LABS BENCHMARK RESULTS
PCMARK 10 - OVERALL (SCORE)
HP SPECTRE X360 (2020) 4,275
HP SPECTRE X360 (2018) 3,753
0 1,000 2,000 3,000 4,000 5,000
CINEBENCH R15 - CPU (MULTI-THREADED)
HP SPECTRE X360 (2020) 646
HP SPECTRE X360 (2018) 456
0 200 400 600 800 1,000
3DMARK TIME SPY (SCORE)
HP SPECTRE X360 (2020) 538
HP SPECTRE X360 (2018) 362
0 200 400 600 800 1,000
BATTERY LIFE - 1080P VIDEO PLAYBACK (H:MIN)
HP SPECTRE X360 (2020) 04:40
HP SPECTRE X360 (2018) 06:24
0 2 4 6 8 10
PCMARK 8 - BATTERY (H:MIN)
HP SPECTRE X360 (2020) 03:35
HP SPECTRE X360 (2018) 05:12
0 1 2 3 4 5
PEAK CPU TEMPERATURE (°C)
HP SPECTRE X360 (2020) 100
HP SPECTRE X360 (2018) 99
0 20 40 60 80 100
CRYSTALDISKMARK READ/WRITE (MB/S)
HP SPECTRE X360 (2020) 2446.5/1245
HP SPECTRE X360 (2018) 3221/1550.6
0 1,000 2,000 3,000 4,000 5,000

# HP Spectre x360 13

## The popular business convertible gets a decent power and features bump.

The Spectre x360 is HP's long standing ultrabook convertible, pitched at professionals who want all the pro perks that you can fit into a 13-inch foldable form factor. This year's update undoubtedly delivers on the same ethos... even if it does cut a couple of corners. Literally. Both the x360's hinge edge corners have been lopped off so the power button and USB-C charging port sit at a more convenient 45-degree angle from all edges.

It also features a new 13.3-inch 4K AMOLED touchscreen that can turn pixels off entirely to produce deeper blacks and a much more vibrant picture. The OLED panel makes it look amazing when playing media and the screen has a Delta E colour variation of less than two, so you'll be able to use the included Adobe RGB and DCI-P3 colour profiles for HDR colour work on the go. While this will appeal to those looking at the higher end of the price bracket, you have the option to configure the unit with a 400 nit 13.3-inch 1,920 by 1,080 pixel IPS panel if you can live without the latest screen specs.

There are a number of configurations of the Spectre X360 and HP has gone down the path of giving retailers exclusive rights to sell specific models, so it's a little difficult to pin down exactly what is available. Broadly speaking, the Spectre x360 comes with either an Intel Core i5-1035G4 or an Intel Core i7-1065G7 CPU. While the former is generally paired with 8GB of RAM and a 256GB SSD, the i7 features either 8 or 16GB of RAM and 512GB of SSD storage.

The Core i5 Spectre x360s is limited to the Full HD variations, while the Core i7 models can choose between 1080p or 4K OLED panels. The i7 models also come with an additional 32GB of Intel Optane Memory which is designed to speed up overall system responsiveness by adding a cache of fast short-term memory to the systems that need it. We didn't notice a massive difference in SSD transfer speeds with read and write paces of 2,447 and 1,245MB/s respectively, but hopefully with software updates the PC should be more responsive overall. This should compliment the new Intel Athena features that aim to focus processing power in order to make laptops more efficient and yet offer responsiveness from sleep or hibernation states.

In practice we haven't noticed a massive difference in use and the overall battery life has actually decreased by 27% from the model we tested last year to four hours and 40 minutes for 1080p movie playback. This makes sense considering the CPU and screen resolution bump, but it still ends up with a big net hit on longevity.

The Spectre x360 13 looks sleek with small bezels and a ten-keyless keyboard that spans the entire width of the device and is springy enough to be nice to type on. The rest of the keyboard surround and trackpad shape mimics the screen's 16 x 9 format, giving the unit a sleek elongated envelope.

The fingerprint reader, webcam that can be mechanically disabled, USB type-A port and MicroSD card reader are all perks that will be appreciated by professional consumers.

The Core i7 Spectre x360 that we tested had more than enough performance for general computing tasks showing a 41.6% boost in performance from an earlier model running an i7-8550U CPU in Cinebench R15. While they share the same processor, we found that the Spectre x360 scored 40% lower in 3D Mark GPU tests than the Surface Pro 7, which shows where HP's priorities lie with this PC.

**Joel Burgess**

### Verdict

**A sleek 13-inch OLED touchscreen convertible with a solid processor and good business perks.**

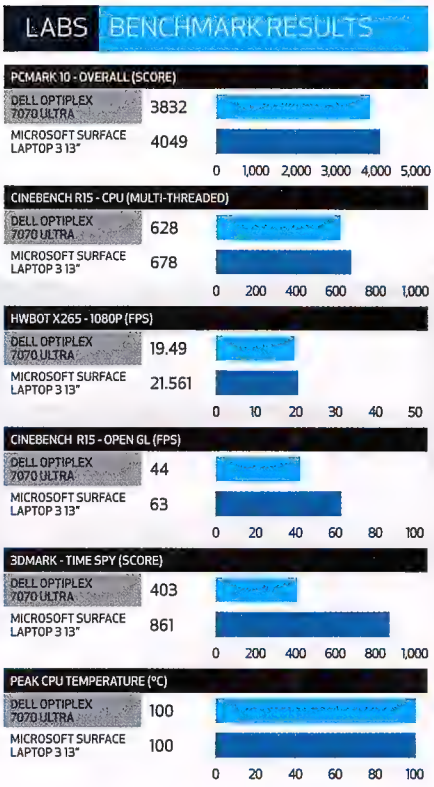
★★★★☆

apc RECOMMENDS

AIO PC

**FROM $1,225 | DELL.COM**

**LABS BENCHMARK RESULTS**


PCMARK 10 - OVERALL (SCORE)
DELL OPTIPLEX 7070 ULTRA 3832
MICROSOFT SURFACE LAPTOP 3 13" 4049
0 1,000 2,000 3,000 4,000 5,000
CINEBENCH R15 - CPU (MULTI-THREADED)
DELL OPTIPLEX 7070 ULTRA 628
MICROSOFT SURFACE LAPTOP 3 13" 678
0 200 400 600 800 1,000
HWBOT X265 - 1080P (FPS)
DELL OPTIPLEX 7070 ULTRA 19.49
MICROSOFT SURFACE LAPTOP 3 13" 21.561
0 10 20 30 40 50
CINEBENCH R15 - OPEN GL (FPS)
DELL OPTIPLEX 7070 ULTRA 44
MICROSOFT SURFACE LAPTOP 3 13" 63
0 20 40 60 80 100
3DMARK - TIME SPY (SCORE)
DELL OPTIPLEX 7070 ULTRA 403
MICROSOFT SURFACE LAPTOP 3 13" 861
0 200 400 600 800 1,000
PEAK CPU TEMPERATURE (°C)
DELL OPTIPLEX 7070 ULTRA 100
MICROSOFT SURFACE LAPTOP 3 13" 100
0 20 40 60 80 100

# **Dell** Optiplex 7070 Ultra

## Dell takes on Apple for the most expensive monitor stand, except this one has a desktop PC inside.

Dell has taken the All-in-One PC concept a step further with a new Dell Optiplex 7070, a PC that takes the shape of a monitor stand. Offering the option to pair the computer with whatever monitor you want without increasing the overall footprint, this PC is an awesome solution for the space conscious amongst us. But while it's conveniently compact, is it actually too small to be broadly useful as a desktop PC?

Before we get into the guts of it, it's worth taking a quick look at how it all fits together. Basically you have a 26 x 10 x 2.6 centimetre PC brick that can either be slotted into an accompanying VESA compatible monitor stand or attached to the back of an existing display using a seperate, included mount. This compact PC has a DC power socket, a few USB Type-A sockets, a USB Type-C DisplayPort and a headphone jack to connect to devices like you would expect.

**"While it's conveniently compact, is it actually too small to be broadly useful as a desktop PC?"**

This compact PC manages to fit either an Intel Core i5-8265U or a Core i7-8565U CPU and eight or 16GB of RAM. These processors may not be part of Intel's most recently announced chips, but the efficient quad-core CPUs boost all the way up to 3.9 and 4.6GHz respectively. Paired with the decent RAM allocation the setup isn't too shabby considering it all fits in a monitor stand. In fact, it'll probably stand up to a number of professional ultrabooks from the last couple of years. The Core i5/8GB RAM model we tested achieved a Cinebench R15 multi-core score of 628 which is only around 8% behind the Microsoft Surface Laptop 3 13-inch running a 10th-gen chip. This equates to more than enough power for simple home and work tasks.

Since the overall footprint of the PC itself isn't dramatically bigger than some of today's phablets, we're not that surprised that the Optiplex 7070 Ultra only offers 256 or 512 GB storage options. What is there however is sufficiently speedy with the Toshiba NVMe SSD offering 1,263MB/s write speeds and over 2,000MB/s read speeds.

For anyone that was hoping to do light gaming or any graphically intensive work the Intel UHD Graphics 620 is one of the more dated elements of this setup. While the CPU often scores within 10% of ultrabooks with comparable 10th gen chips, the GPU was between 32 and 54% behind the latest Intel Iris Plus integrated graphics processors.

When your pitch is a PC that fits into a monitor stand to save space, it makes sense that your customers would also be interested in clever ways to minimise cable clutter, so we'd recommend budgeting for a nice wireless mouse and keyboard with this unit.

At the time of writing Dell had its Optiplex 7070 range on a 50% sale (something we've come to expect from Dell's online store) and so while these PCs are great for the sale price, they're not really competitive if you're paying top dollar. ■ **Joel Burgess**

### Verdict

**An innovative alternative to an all-in-one, offering as much power as today's premium ultrabooks.**

★★★★☆

**$1,699 – $2,899 | WWW.MICROSOFT.COM**

# Surface Pro X

## Microsoft's answer to the iPad Pro has its ups and downs.

Microsoft's newest attempt at an ARM-based Surface Pro device could have been impressive as well. It even boasts Microsoft's first-ever original processor, the SQ1, which it co-developed with Qualcomm.

However, it unfortunately falls short of expectations. We're more than a little let down by a few key Pro X design choices. Particularly, this tablet/laptop hybrid doesn't have an audio jack, and its battery life, while decent, is subpar compared to predecessors and contemporaries. And, that's without getting into the pricing. $1,699 gets you 8GB of RAM and a 128GB SSD. You can double the storage, which brings the price to $2,149, and up the RAM to 16GB with a 512GB SSD, which costs $2,899. It's simply too pricey for this level of performance.

All Surface Pro X models include Microsoft's Qualcomm Snapdragon-based 3.0GHz SQ1 processor, as well as the 13-inch, 267 pixels per inch, PixelSense touch display in the signature 3:2 aspect ratio. You already know the kicker, don't you? That's right, these prices do not include the Type Cover with the stowable and automatically charging Surface Slim Pen. They will cost you $430 more.

This means that the cheapest version of the complete Surface Pro X experience will cost you $2,129 for the bare minimum of acceptable memory and storage. Meanwhile a Surface Pro 7 with the same memory and storage goes for $200 less and will get you a much stronger Intel processor.

### DESIGN AND DISPLAY

The Surface Pro X simply trims and rounds out the classic yet dated Surface Pro design, bringing down its thinness and weight further. The tablet feels impressively light, and slips easily into almost any bag – even with the Type Cover attached. Microsoft has also eliminated the hard angles of the classic Surface Pro design, giving the Pro X a much more rounded and modern look and feel that's closer to that of a smartphone.

We appreciate these subtle design changes that make the Surface Pro X feel more like an iPhone XR than a Windows tablet – which is a compliment.

There's just one color option for the Surface Pro X: a matte black aluminum finish paired with a black Type Cover that drops the Alcantara fabric, and that's unfortunate. This is certainly a sleek and unassuming look, to be sure, so it's not all that bad.

However, we have one massive problem with the Surface Pro X design. While it has gained not one, but two USB-C ports, there is no headphone jack on the tablet. This is essentially a Windows laptop (after all, Microsoft claims that this tablet can replace your laptop) with no 3.5mm audio support.

We know that the iPad Pro has also dropped the headphone jack, and folks didn't break a sweat over that. However, no one in their right mind seriously expects a laptop experience from an iPad, while that's exactly what we've been

> "It drops the headphone jack to achieve its thinness, and that's a really tough pill to swallow."

trained to expect from a Surface Pro. This is a major detraction in our book, and should be rectified in any follow-up device.

As for typing on the new Type Cover, it's plenty comfortable and impressively accurate for a keyboard cover, though it does bounce under key presses more noticeably than before. We also appreciate the ergonomic angle staying with the new stowaway barrel for the Surface Pen Slim.

While we're at it, let's discuss the Surface Pen Slim. The stylus is now flatter than before in order to accommodate the new storing and charging functions. However, it feels just as pleasing and accurate to doodle and draw with. All of the standard pressure sensitivity is present, and the display's palm rejection is still spot-on.

As for that display, it is a 13-inch PixelSense touchscreen with a 2,880 x 1,920 resolution (267 pixels per inch) and a 3:2 aspect ratio. This is a simply gorgeous screen with excellent color, and it's also impressively bright at 450 nits.

Honestly, we're left a little puzzled by the Surface Pro X design. It certainly looks and feels thinner, lighter and better than previous Surface Pro models. However, it drops the headphone jack to achieve that thinness, and that's a really tough pill to swallow.

## PERFORMANCE

Unfortunately, because of the ARM-based processor, we were only able to run Geekbench and our video-based battery rundown test on the Surface Pro X. That's at least enough for us to compare it to its number one rival, the iPad Pro.

So, how does Qualcomm's 7-nanometer SoC compare against the Apple A12X Bionic? Well, it gets trounced, to be frank. We've seen the latest 12.9-inch iPad Pro achieve numbers 40% to 50% higher than the Surface Pro X in the Geekbench 4 single- and-multi-core tests.Granted, these are two different operating systems, but both processors were designed specifically to perform within their respective OSes, so that explanation doesn't fly these days.

While day-to-day tasks, like checking your emails, browsing the web and creating documents in Microsoft Office, ran pretty well on the Surface Pro X, trying to do anything more strenuous than that could cause problems. You might get away with editing photos and other images on this tablet, but that's about the extent of it.

## BATTERY LIFE

Microsoft promises up to 13 hours of mixed usage time for the Surface Pro X, touted as one of the tablet's most appealing features due to its new ARM-based silicon. Well, we're sad to say that this hasn't panned out in our testing.

The Surface Pro X did last longer than the Surface Pro 7 (6 hours and 2 minutes) in our video rundown battery test, but the older Surface Pro 6 (8 hours and 45 minutes) lasted nearly an hour longer than this model from the Surface family.

This is more than likely due to the even sharper display within the Surface Pro X than its two predecessors, not to mention brand new silicon compared to the umpteenth iteration of the 14nm Intel processor in the Surface Pro 6.

In the end, while the Surface Pro X battery life is undoubtedly long, it's just not as long as Microsoft's Pro 6, which holds the crown for longest lasting Surface Pro tablet to date.

If portability is your chief concern in buying a new laptop, then consider the Pro X for sure. This is the thinnest, lightest Surface to date, but it's difficult to recommend for most people.

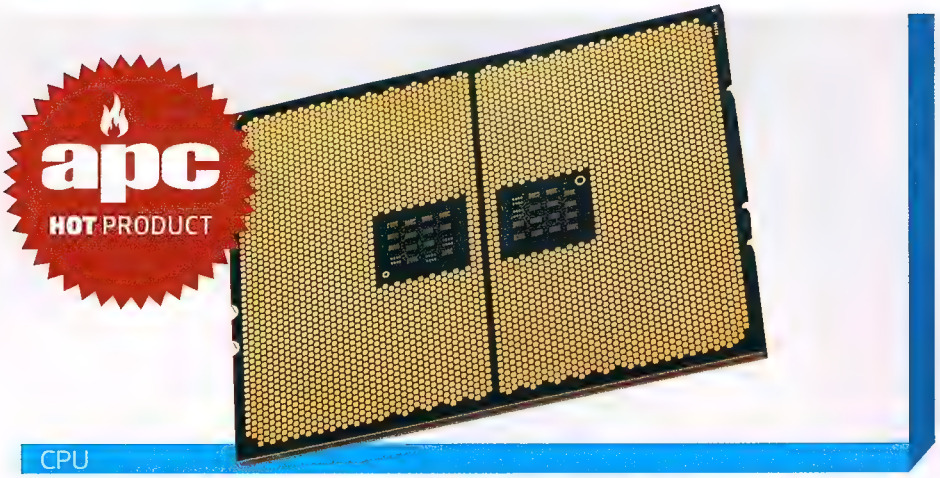
■ APC

## Verdict

**We applaud the Surface Pro X for its refined design, but it's an ideal device for a very small group.**

BENCHMARKS

| | BLENDER 2.80 BETA BMW (PPS) | CINEBENCH R15 SINGLE/MULTI (INDEX) | POV-RAY 3.7.1 SINGLE/MULTI (PPS) | PCMARK 10 (INDEX) | METRO EXODUS (FPS) | TOM CLANCY'S THE DIVISION 2 (FPS) | TOTAL WAR: WARHAMMER II (FPS) |
|---|---|---|---|---|---|---|---|
| AMD THREADRIPPER 3970X | 10,651 | 210/7,573 | 521/14,754 | 7,278 | 71 | 149 | 72 |
| INTEL CORE I9-10980XE | 5,912 | 204/3,799 | 571/9,379 | 7,344 | 87 | 151 | 82 |
| AMD RYZEN 9 3950X | 5,719 | 213/3,992 | 539/8,334 | 7,963 | 90 | 148 | 90 |




CPU

**$3,199 | WWW.AMD.COM**

# AMD Ryzen Threadripper 3970X

## Third-generation Threadripper is the new king of cores.

AMD has thrown down the gauntlet with the third round of Threadripper, delivering many of the fastest benchmark results I've ever seen.

Intel's response is telling. It slashed prices on its 10th-gen Cascade Lake-X parts. It's still not enough – at least, not if you're after maximum multithreaded performance. AMD and Intel have now swapped positions in terms of pricing, with the Threadripper 3970X occupying Intel's former three-grand slot. At least the platform and hardware justify the cost.

At times, the performance of the 3970X is mind-blowing. Anyone dabbling in 3D rendering will love how fast it is. Cinebench completes its baseline test in a matter of seconds – we remember waiting several minutes just a few years ago on some PCs. The same goes for other tools, such as Blender, Corona, and POV-ray. Other multithreaded tasks start to hit the limits of scaling, however. Video editing is faster than on a 16-core Ryzen 9 3950X, but nowhere near twice as fast. Software development with large projects should benefit, though, as should several other professional applications.

AMD's new TRX40 platform makes some noteworthy changes to help with scaling and performance. Moving the memory controller into the IO chiplet means memory access speeds should be more uniform this round. AMD also links the CPU package and chipset with a PCIe x8 connection, and upgrades the interface to PCIe Gen4, giving it four times the bandwidth between the CPU and chipset compared to other CPUs. The only potential drawback is that this means third-generation Threadripper had to ditch backward compatibility – you can't put a 3970X into an X399 motherboard.

Depending on the app and workload, 3970X is either thread and shoulders above the competition, or it occasionally stumbles. Gaming performance is mostly OK, but several games seem to get confused by the deluge of cores and threads. *Far Cry 5*, *Metro Exodus*, and *Total War: Warhammer 2* all perform worse than a Ryzen 9 3950X (or even a 3900X), but seven other games we tested tied. General performance, measured by PCMark 10, is also worse than a Ryzen 9 3950X, and Handbrake H.265 1080p encoding is only 12 percent faster, despite having twice the cores to work with.

Much like *Field of Dreams*, we believe if you build it (Threadripper), they (apps) will come. Ten years ago, the fastest PCs had four-core CPUs. Ten years before that, the only PCs with more than a single CPU core were multisocket servers. What will PCs look like 10 years from now?

Not everyone needs a 32-core monster CPU, but if you do, AMD is pretty much the only game worth watching. AMD's Zen 2 processors are fabricated on a superior 7nm process, allowing for more cores, less power, and higher clock speeds. Intel desperately needs to get 10nm desktop parts on to the market if it wants to compete, and by the time those arrive, maybe 7nm as well. ■ **Jarred Walton**

### Verdict

**Massive multithreaded performance; 7nm technology; innovative chiplet design.**

apc RECOMMENDS

SSD

**FROM $300(500GB) | SHOP.WESTERNDIGITAL.COM**

# WD Black P50 Game Drive

## New USB spec puts portable SSD speeds in the black.

The external hard drive market isn't the fastest developing area of tech, so when something like a new USB specification comes along it can entirely change the landscape. The USB 3.2 spec was announced back in February 2019, but WD's Black P50 Game Drive is the first external SSD we've seen to actually make use of it, so it's kind of a big deal.

There are a couple of things that stop today's external hard drives from reaching the 2,000MB/s plus read and write speeds you see internal SSDs getting, but the main bottleneck is the type of connection. External SSDs generally use a SATA 3 (6Gbps) connection to communicate with your computer, which means you aren't able to get much above 500MB/s read and write speeds. Samsung took a swing at improving this by using the much faster Thunderbolt (40Gbps) connection in its X5 Portable SSD, however the proprietary controllers were pricey, the Thunderbolt connection is not used by all the latest PCs and after 15 seconds the drive heated up to a point that it needed to throttle itself to be slower than 550MB/s.

USB 3.2 is the third generation of USB 3 connection and this new specification adds an additional lane of USB 3.1 (Gen 2) bandwidth to double the throughput from 10Gbps to 20Gbps. This isn't as fast as the 40Gbps you get from Thunderbolt, but USB 3.2 is purportedly cheaper to implement than Thunderbolt and will be in many new computers going forward. Additionally, because USB 3.2 is justtwo lanes of USB 3.1 (10Gbps) it means that the WD Black P50 can get over 1,000MB/s read and write speeds if you use it with an older USB 3.1 port.

Because it's compatible with Type-A or Type-C USB sockets, if you have no choice but to connect the WD Black P5 to a standard USB Super Speed port you'll get the same speed as any other external SSD. This might not seem like much of a bonus, but against the Samsung X5, which connects to a Thunderbolt port or nothing, this versatility is occasionally a lifesaver.

To get the full 2,000MB/s speeds you'll need to have the latest USB 3.2 (Gen 2) interface on your PC. At the time of writing we couldn't actually track down a device sporting a USB 3.2 port, so we aren't able to verify WD's claims of 2,000MB/s peak read and write speeds, however there were a range of motherboards released late in 2019 that are compatible.

We were able to get CrystalDisk Mark 6 read and write speeds of around 1,000MB/s when transferring over a USB 3.1 (10Gbps) connection, however in real world movie transfers the drive generally operated at 650-700MB/s.

The WD Black P50 won't ever be quite as fast as the Samsung X5's 2,687MB/s read and 2,169MB/s peak write speeds, but it's at least likely to not be far off with the right setup. It's also better priced, has no compatibility issues and doesn't seem to overheat. ■

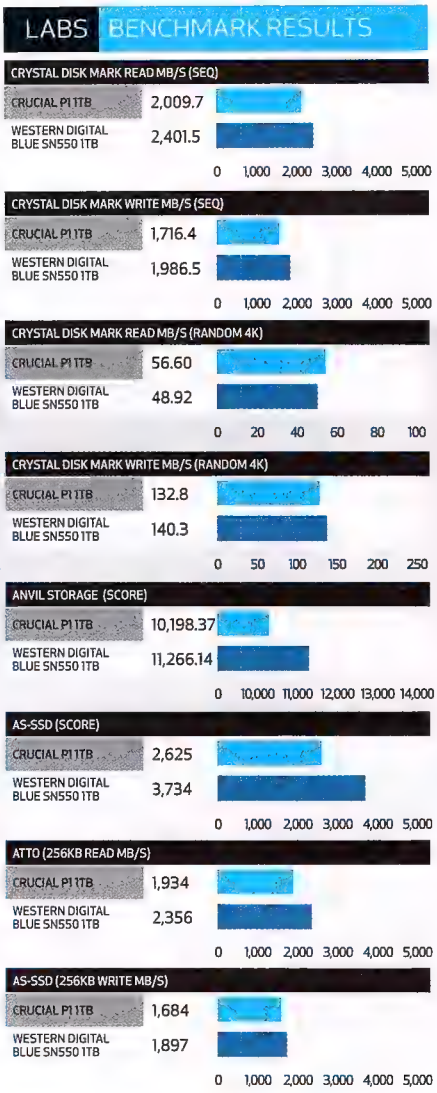
### Verdict

**One of the fastest external SSDs that is backwards compatible with whatever USB spec you have on hand.**

★★★★☆

SSD

$180 | WWW.WESTERNDIGITAL.COM


LABS BENCHMARK RESULTS
CRYSTAL DISK MARK READ MB/S (SEQ)
CRUCIAL P1 1TB 2,009.7
WESTERN DIGITAL BLUE SN550 1TB 2,401.5
0 1,000 2,000 3,000 4,000 5,000
CRYSTAL DISK MARK WRITE MB/S (SEQ)
CRUCIAL P1 1TB 1,716.4
WESTERN DIGITAL BLUE SN550 1TB 1,986.5
0 1,000 2,000 3,000 4,000 5,000
CRYSTAL DISK MARK READ MB/S (RANDOM 4K)
CRUCIAL P1 1TB 56.60
WESTERN DIGITAL BLUE SN550 1TB 48.92
0 20 40 60 80 100
CRYSTAL DISK MARK WRITE MB/S (RANDOM 4K)
CRUCIAL P1 1TB 132.8
WESTERN DIGITAL BLUE SN550 1TB 140.3
0 50 100 150 200 250
ANVIL STORAGE (SCORE)
CRUCIAL P1 1TB 10,198.37
WESTERN DIGITAL BLUE SN550 1TB 11,266.14
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AS-SSD (SCORE)
CRUCIAL P1 1TB 2,625
WESTERN DIGITAL BLUE SN550 1TB 3,734
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ATTO (256KB READ MB/S)
CRUCIAL P1 1TB 1,934
WESTERN DIGITAL BLUE SN550 1TB 2,356
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AS-SSD (256KB WRITE MB/S)
CRUCIAL P1 1TB 1,684
WESTERN DIGITAL BLUE SN550 1TB 1,897
0 1,000 2,000 3,000 4,000 5,000

# Western Digital Blue SN550 1TB NVMe SSD

## The best mainstream NVMe SSD on the market right now.

We were very impressed with the SN550's predecessor. It offered tremendous value for money, though it wasn't the fastest drive around. The new SN550 we have for review here is faster on paper, while offering the same value. That alone makes it a worthy contender in a highly competitive marketplace.

The WD Blue SN500 is a standard form factor M.2 2280 (80mm length) NVMe drive that makes use of a PCIe 3.0 x4 interface. A look at the PCB reveals a distinct lack of components, an indicator that modern SSDs are becoming cheaper than ever to manufacture. It would be very easy for WD to release a 2242 size drive if it chose to. The SN550 makes use of Western Digital's latest 96 layer TLC NAND. The use of TLC, with its inherent endurance advantages over QLC, means the SN550 has an excellent endurance rating of 600 terabytes written, and a 1.7 million hour MTBF rating (190 years+!) backed with a five year warranty.

As a budget-level drive, you won't get the higher end bells and whistles like full disk encryption or a large cache. You do get WD's Dashboard SSD software package that includes features such as firmware updating, S.M.A.R.T. reports and various performance and health monitoring. It's a good little piece of software.

The WD Blue SN550 comes up against strong competition from the ageing Intel 660P and particularly the Crucial P1. The P1 cannot match the sequential performance of the SN550, though it is competitive with its low latency and IOPS which are just as important. As we see in the benchmark results, the SN550 provides well rounded performance. The WD beats the Crucial drive more often than not, though drives in this range cannot compete with the Samsung 970's or WD's own Black SN750. Of course those drives cost a lot more. So, while the WD Blue won't win any speed records, it's got enough to elevate it well beyond SATA drives, while costing less than a lot of them. What's not to like about that!

The 1TB SN550 is selling for $180 at the time of writing. This is a tremendous price for a drive that offers a solid level of performance. There are faster NVMe drive available, but the real world advantages of that extra speed are not always apparent to the everyday user. The pressure is on the likes of Intel and Samsung to release drives that offer similar value. SATA is quickly becoming useful for mass storage only, or systems with a limited number of M.2 slots and/or PCIe lanes. WD's SN550 offers sensational value to go along with its decent performance and it's an excellent choice for mainstream users.

**Chris Szewczyk**

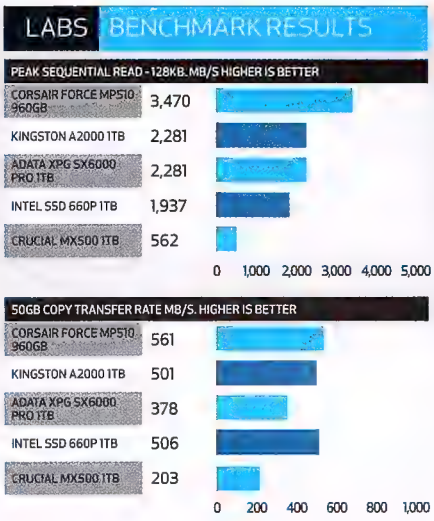
### Verdict

WD's latest NVMe SSD offers tremendous value and performance that leaves SATA drives in the dust.

apc HOT PRODUCT

SSD

**$179 (1TB), $108 (500GB), $68 (250GB) | KINGSTON.COM**


LABS BENCHMARK RESULTS
PEAK SEQUENTIAL READ - 128KB: MB/S HIGHER IS BETTER
CORSAIR FORCE MP510 960GB 3,470
KINGSTON A2000 1TB 2,281
ADATA XPG SX6000 PRO 1TB 2,281
INTEL SSD 660P 1TB 1,937
CRUCIAL MX500 1TB 562
0 1,000 2,000 3,000 4,000 5,000
50GB COPY TRANSFER RATE MB/S. HIGHER IS BETTER
CORSAIR FORCE MP510 960GB 561
KINGSTON A2000 1TB 501
ADATA XPG SX6000 PRO 1TB 378
INTEL SSD 660P 1TB 506
CRUCIAL MX500 1TB 203
0 200 400 600 800 1,000

# Kingston A2000 SSD 1TB

## It may not be the fastest NVMe SSD, but it offsets that with enhanced security and low pricing.

Like its bigger brother the KC2000, Kingston's new A2000 uses a Silicon Motion controller and Micron's 96L TLC flash. However, the SSD's controller limits performance to about 2.2/2.0 GB/s read/write, which results in lower pricing. The drive still performs well, has a long warranty, and also features heavy-duty hardware encryption options that also offset the more conservative performance specifications.

The combination of features makes Kingston's A2000 a formidable entry-level M.2 NVMe SSD. With a four-channel Silicon Motion SM2263EN PCIe NVMe controller and Micron's latest 96L TLC powering it, it has got a lot of fight in it. Need to load up your favorite games fast? Easy. Want to host multiple virtual machines? Not a problem. Edit high bit-rate video? It should be a piece of cake with the A2000.

The A2000 is also a great pick if you have sensitive data and want to upgrade your business laptop. The self-encrypting drive supports 256-bit XTS-AES hardware-based encryption at the controller level, so you can password-protect your data with no performance loss. And, with TCG Opal 2.0 support, you can manage the security with Symantec, McAfee, WinMagic, and other business-class security software. As a byproduct of its eDrive support, it also supports BitLocker.

Kingston rates the A2000 for up to 2.2/2.0 GBps of read/write throughput, and it can dish out 250,000 / 220,000 of random read/write IOPS, too. It comes with high-end endurance ratings that match both the Samsung 970 EVO Plus and WD Black SN750. And, like them, it comes with a five year warranty.

Feature-wise, other than the AES 256-bit encryption, the drive has a pseudo-SLC write cache that absorbs inbound writes. It supports TRIM, S.M.A.R.T. data reporting, and you can secure erase it (Format NVM) to ensure your data is completely gone when you sell it, or to restore performance if the drive gets into a degraded state.

Compared to a WD Black HDD for reference, the A2000 scored an average bandwidth that was 47 times greater in PCMark 8, 13 times higher in SPECworkstation 3, and was five to seven times faster during file transfers. If you aren't been convinced yet, these scores should provide enough reason to upgrade to an A2000 or similar if you haven't done so already.

Best of all, the A2000 ranked as the fastest SSD in the group when loading *Final Fantasy*'s game scenes, making it great value for gamers. But if you care about aesthetics, it may stick out like a sore thumb if you don't place it under a heatsink. That is not to say it needs one, however. During our tests, the A2000's temperatures were well-managed. Even when running multiple 50-100GB transfers simultaneously, temps stayed below 60C with little airflow in our 25 degree environment.

Kingston's A2000 is a well-rounded NVMe SSD overall. Whether you're a business-class user, prosumer, or just someone looking to outfit their new build with some speedy storage, the A2000 is a great choice. With competitive pricing, high endurance and five-year warranty to match, the drive ranks alongside the WD Blue SN550 (facing page) as the top value pick. ■ **Sean Webster**

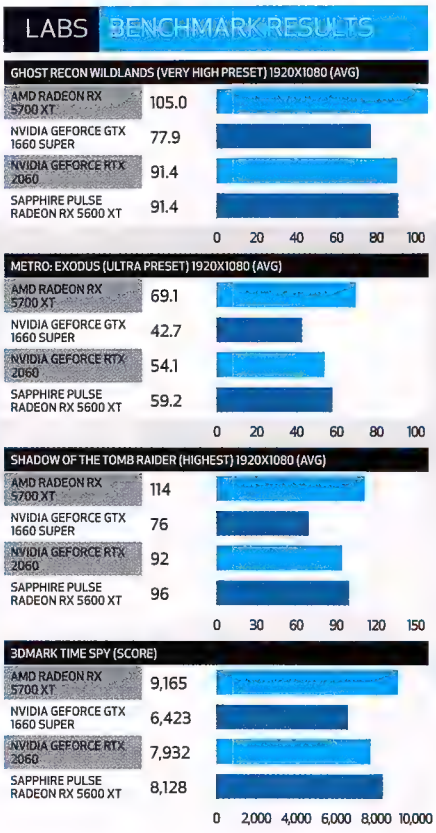
### Verdict

**A top pick with hardware encryption, competitive performance, and great pricing too.**

★★★★★

GRAPHICS CARD

**$485 | WWW.SAPPHIRETECH.COM**


LABS BENCHMARK RESULTS
GHOST RECON WILDLANDS (VERY HIGH PRESET) 1920X1080 (AVG)
AMD RADEON RX 5700 XT 105.0
NVIDIA GEFORCE GTX 1660 SUPER 77.9
NVIDIA GEFORCE RTX 2060 91.4
SAPPHIRE PULSE RADEON RX 5600 XT 91.4
0 20 40 60 80 100
METRO: EXODUS (ULTRA PRESET) 1920X1080 (AVG)
AMD RADEON RX 5700 XT 69.1
NVIDIA GEFORCE GTX 1660 SUPER 42.7
NVIDIA GEFORCE RTX 2060 54.1
SAPPHIRE PULSE RADEON RX 5600 XT 59.2
0 20 40 60 80 100
SHADOW OF THE TOMB RAIDER (HIGHEST) 1920X1080 (AVG)
AMD RADEON RX 5700 XT 114
NVIDIA GEFORCE GTX 1660 SUPER 76
NVIDIA GEFORCE RTX 2060 92
SAPPHIRE PULSE RADEON RX 5600 XT 96
0 30 60 90 120 150
3DMARK TIME SPY (SCORE)
AMD RADEON RX 5700 XT 9,165
NVIDIA GEFORCE GTX 1660 SUPER 6,423
NVIDIA GEFORCE RTX 2060 7,932
SAPPHIRE PULSE RADEON RX 5600 XT 8,128
0 2,000 4,000 6,000 8,000 10,000

# Sapphire Pulse RX 5600 XT 6G

## Is this the best $500 graphics card right now?

Gamers have had a lot of reading to do to help them determine the best graphics cards to buy in the mid-range market. The last few months have seen the release of Nvidia's 1600-series Super cards, AMD's RX 5500 XT and now we have another disruptive entry to add to the mix, the RX 5600 XT. The 5600 XT is a very interesting card indeed, and one that AMD believes is the one that can cause arguably the biggest mid-range realignment of this generation. Let's see if it holds up to this promise.

The RX 5600 XT is equipped with the Navi 10 GPU, with clock speeds and memory spec being the primary differences between it and the more expensive RX 5700. Both cards include 2,304 shader processors. Strangely, AMD decided to equip the 5600 XT with 6GB of RAM, an odd choice given the lower tier 5500 XT ships with 8GB, not to mention that next generation consoles will have 8GB. Will 6GB be enough for uncompromised 1080P gaming in, say, two years? We'll have to wait and see.

AMD made the 11th hour call to increase the 5600 XT's clock speeds, likely in response to Nvidia's revised RTX 2060 pricing. But leaving BIOS flashing to end users is a haphazard decision at best, and is a risky strategy from AMD. Obviously AMD *really* didn't want to drop the price. We tested with the new BIOS, specifically the performance version as the silent one gives up too much performance for limited gain.

Thee card tested is Sapphire's Pulse RX 5600 XT. Pulse cards are Sapphire's mid-tier products, above the basic reference cards, and below the Nitro series cards. It comes with dual BIOS', but there isn't much point to using the silent BIOS given how quiet the card is anyway. It's an attractive and very well built card. Do note that it's essentially a triple slot card.

AMD is positioning the 5600 XT as the ultimate 1080p card, and the performance results back that up. The new BIOS pushes it ahead of the RTX 2060, and therefore the entire 1660 series. We were also very impressed with Sapphire's cooler. The card remained essentially silent at all times. We never saw temperatures go higher than 70 degrees C, meaning the card was able to maintain impressive boost clocks in the 1,720MHz range for long periods. In fact with the silent running levels, we wouldn't even bother with the silent BIOS as you'll lose too much performance for no apparent advantage apart from saving a few watts.

Sapphire's Pulse RX 5600 XT is a very impressive and aggressively priced 5600 XT. With its newly boosted clock speeds, it's highly competitive with Nvidia's offerings. It beats the RTX 2060 on price and performance, while remaining quiet with good thermals and power consumption levels. We really wish it had 8GB for that extra bit of future proofing. 8GB also looks better on the box to uninformed buyers. If you've got $500 to drop on a graphics card right now, and don't care about the RTX feature set, then the 5600 XT is the card to get. ■

### Verdict

**The RX 5600 XT is very competitive in its price range but we wish AMD had included 8GB of RAM.**

IMAGE: SHARNEE SWINNERTON

MONITOR

**$429 | SAMSUNG.COM**

# Samsung C27RG5

## A 27-inch, 240Hz, G-Sync curved gaming monitor that has competitive gamers in its crosshairs.

Back in the January issue of *APC* we took a look at how faster monitors have been shown to significantly improve response times in fast paced games like competitive first person shooters. In addition to displaying opponents changing positions on the screen more quickly, it also helps players track targets and reduces distracting artefacts like ghosting and screen tearing, in what adds up to a better kill-to-death ratio for anyone using screens faster than 180fps.

Improving your performance is a metric that any serious gamer is likely to take note of, so Samsung's new 27-inch curved gaming monitor is worth consideration for anyone looking to improve their gaming performance. Obviously the most notable feature of this screen is the 240Hz refresh rate – a speed that means there's only a handful of monitors available locally that really compete with it. Generally you pay a premium for cutting edge gaming tech, so we're not surprised the average lowest price for comparable monitors from Asus, MSI, Gigabyte and BenQ is $681. Samsung on the other hand, is selling its C27RG5 for a RRP of $429 and we've seen it going for as little as $389.

You might think that the 43% discount here means you'll have to sacrifice in some areas, but Samsung's 27-inch 240Hz monitor is bigger than most of the 24-inch competition, offers proprietary Nvidia G-Sync compatibility and has a considerably larger 3000:1 contrast ratio. The price and vibrancy are down to Samsung's use of VA panels rather than TN technology, and while on most fronts it's an improvement it does come with one downside; a 4ms response time. For most people the difference between 4ms and 1ms will be imperceivable and saving $300 by sacrificing here is a no-brainer, but for those that actually get paid to play games, this is potentially a hair worth splitting. Then again if you look at overall input lag the C27R5 was actually the fastest monitor that *Tom's Hardware* had on file with a PC to screen rendering lag of just 18ms.

The C27RG5 runs at a max resolution of 1,920 by 1,080 pixels, which makes sense when you consider a Nvidia GTX 2080 Super will only get 144fps averages on 1080p Ultra graphical settings in Call of Duty Modern Warfare (2019). So you'll probably need to dial down the graphical quality a little in order to make the most of this display. Samsung reports a typical brightness of 300nits which is similar to the competition, but VA panels have much better viewing angles than anything you can get using a TN screen.

The screen is nearly bezelless on the top and sides and has a conveniently placed menu control on the bottom centre edge. The display won't need any colour calibration if you use the DisplayPort 1.2 input, however you may need to cycle through a few colour and black level preserts if you intend on using one of the two HDMI 2.0 inputs. We were a little disappointed that there was no Thunderbolt/USB 3.1 input, but this was the only negative thing we really had to say about the C27RG5. ■

**Joel Burgess**

### Verdict

**The fastest VA gaming panel we've tested offering better colour at a much better price.**

★★★★★

# ASUS

## THE BEST GRAPHICS CARDS AND MONITORS FOR RAY TRACING.

In 2020 ray tracing is going to be huge in games. Already we're seeing PC games like Control, Battlefield V, and Metro Exodus making phenomenal use of this technique, which allows developers to render objects and environments in near-photorealistic quality in real time, dramatically increasing the fidelity of modern games. Shadows, reflections, refractions – thanks to ray tracing, artists can now display game worlds with a level of fidelity that was previously not possible. Ray tracing is the new holy grail for game graphics, and the results speak for themselves. Even Minecraft's blocky voxel style is being updated for ray tracing, and it looks amazing – soon all the major AAA PC releases are going to embrace this technology.

ASUS is making ray tracing possible for PC gamers with its latest graphics cards and monitors, which will let you render and display your games at the highest level of quality. This issue, we're looking at two graphics cards – the compact Dual GeForce RTS 2070 MINI for smaller builds, and the limited edition STRIX-RTX2080Ti-O11G-White-Gaming for beefier PCs. We're also looking at two exciting new Republic of Gamers monitors that are on the horizon. No matter what your build looks like, these cards and monitors will help you get the most out of your games.

The STRIX-RTX2080Ti-O11G-White-Gaming combines gaming power with a striking design.

### SMALL, BUT PERFECTLY FORMED

The Dual GeForce RTX™ 2070 MINI graphics card, designed with the new Intel NUC 9 Extreme Kit and Pro Kit in mind, packs incredible performance into a small-form-factor, low-temperature package. If you're looking to squeeze the highest performance possible out of a mini-PC, this card, which features 8GB of GDDR6 memory and a memory clock of 14,000MHz, is the new benchmark. It uses DirectX12 to achieve the highest-quality visual effects and rendering techniques (including ray tracing) and supports NVIDIA Shadowplay for superior video recording and livestreams. The GPU Tweak II utility allows you to tune your card as you see fit, making for a versatile, extraordinarily powerful card that will get the biggest performance out of the smallest PCs. There's no need to worry about your card running hot either, no matter how hard you push it—it comes outfitted with two Axial-tech fans, a custom dual-slot thermal solution, and Auto-Extreme technology that reduces thermal strain on the card's components, making it reliable over a long period of time.

The Dual GeForce RTX™ 2070 MINI graphics card is perfect for SFF builds.

## RTX-POWERED GAMES

### OUT NOW

- BATTLEFIELD V
- SHADOW OF THE TOMB RAIDER
- METRO EXODUS:THE TWO COLONELS
- CALL OF DUTY: MODERN WARFARE
- STAY IN THE LIGHT
- QUAKE II RTX
- WOLFENSTEIN: YOUNGBLOOD
- CONTROL

### COMING SOON

- MINECRAFT
- CYBERPUNK 2077
- WATCH DOGS: LEGION
- VAMPIRE: THE MASQUERADE BLOODLINES 2
- DYING LIGHT 2
- SYNCED: OFF-PLANET
- DELIVER US THE MOON

### BIG ON POWER

If you're after a full-sized, stylish, extremely powerful graphics card, ASUS has you covered there too. The limited edition STRIX-RTX2080Ti-O11G-White-Gaming takes the attractive white design that ASUS has typically reserved for mainstream graphics cards and applies it to an absolute powerhouse. It's a striking design, but more important than looks is how smoothly it'll make your games run. This extraordinary card allows for aggressive overclocks of GPU memory, up to an unrivalled 14Gbps. ASUS has achieved performance boosts through selective mining, meaning that you can push performance to the absolute limits on all the latest games – not to mention the heavy-hitters that are just around the corner, like Cyberpunk 2077. You can overclock up to 1770MHz with this card – it's designed for PC enthusiasts who really want to push their rig to the limits. The incredible STRIX cooler means that you won't need to worry about all that power overheating your tower, either – its three fans feature longer blades than ever before and a barrier ring to increase downward air pressure, and the 2.7-slot design means more heatsink surface area. Dual BIOS even lets you choose between prioritising low temperatures or low noise levels.

### PREMIUM DISPLAY OPTIONS

Of course, the graphics your PC produces can only ever be as good as the monitor they're displayed on, and ASUS has some innovative, glorious screens available that will show off the true power of ray tracing. ASUS debuted two new monitors at CES 2020, and they're both stunners.

ASUS' upcoming 360Hz G-Sync gaming monitor has been designed with esports in mind. If you want to take advantage of the highest frame-rates possible in your games, this is the monitor for you – it's a world first, featuring 360Hz esports design technology for stunningly fluid gameplay. This screen's refresh rates are for anyone looking to play at a competitive level, achieving performance well beyond even the flashiest 240Hz monitor. Monitors like this will eventually become the industry standard for pro players. This 24.5-inch model is designed to look amazing on your desk, too, with a sleek design and premium build quality. It's a serious screen, designed for anyone who really wants to have an edge and pull ahead of the pack in their competitive gaming.

If you're not looking to go pro but still want extraordinary performance, ASUS also has the best 4K monitor on the market. The PG32UQX is the first MiniLED G-Sync ULTIMATE gaming monitor ever designed, another truly innovative product that will give players the most natural and realistic HDR experience. This 32-inch monitor features more saturated colours, extremely bright whites (and darker blacks), and a display quality that will absolutely knock your socks off – the perfect way to show off what your PC is capable of. It features a full-array, local dimming Mini LED backlight, with 1152 zones – in other words, it'll make for extremely dynamic images, and perfectly capture every detail in your 4K games. Throw in ray tracing and you'll have the most immersive, stunning gaming experience possible right now. It can display the full DCI P3 colour gamut and reaches the absolute top-tier of G-Sync Ultimate certified monitors. It's also perfect for 4K movies and videos, and it even offers a pixel density designed to make everyday desktop Windows use easy, without the need for scaling, despite its enormous size. This is a monitor that will remain cutting-edge for years to come and will suit all your needs.

2020 is going to be a huge year for PC games, with the release of new consoles leading to developers pushing themselves harder than ever to capture the best graphics imaginable. If you're running a PC capable of 4K output and ray tracing, you'll have it better than anyone. With ASUS' new graphics cards and monitors, you can experience the absolute cutting edge, and boost your games to look better than any game has ever looked. ■

Pro gamers will love Asus' new 360Hz-capable display.

# software

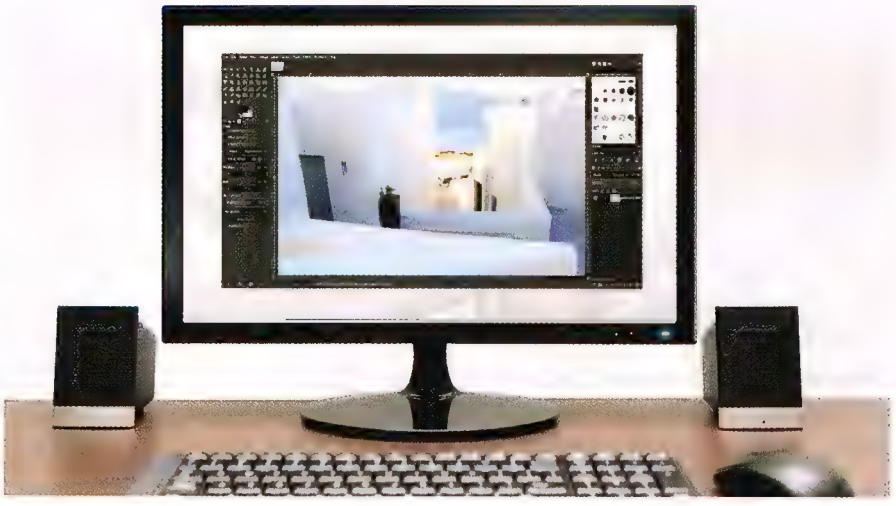
» APPS FOR ALL YOUR PLATFORMS

## Windows SOFTWARE

# GIMP

### The best of the free apps.

**FREE | WWW.GIMP.ORG**



GIMP (the GNU Image Manipulation Program) is the best free photo editor around. It's packed with the kind of image-enhancing tools you'd find in premium software, and more are being added every day.

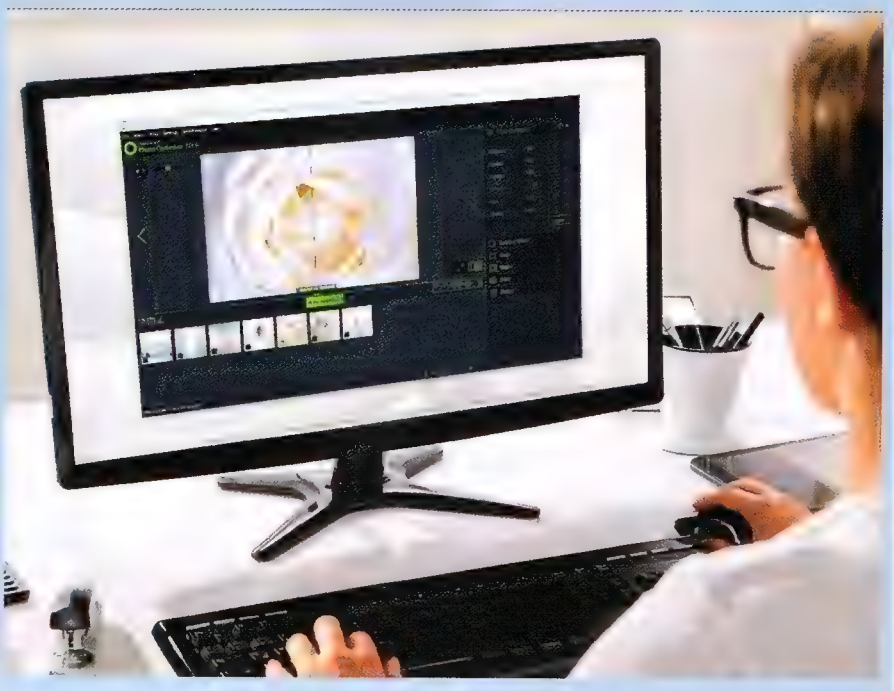
The photo editing toolkit is breathtaking, and features layers, masks, curves, and levels. You can eliminate flaws easily with the excellent clone stamp and healing tools, create custom brushes, apply perspective changes, and apply changes to isolated areas with smart selection tools.

GIMP is an open source, free photo editor, and its community of users and developers have created a huge collection of plugins to extend its utility even further. Many of these come pre-installed, and you can download more from the official glossary. If that's not enough, you can even install Photoshop plugins.

## Ashampoo Photo Optimizer 2019

Enhance...

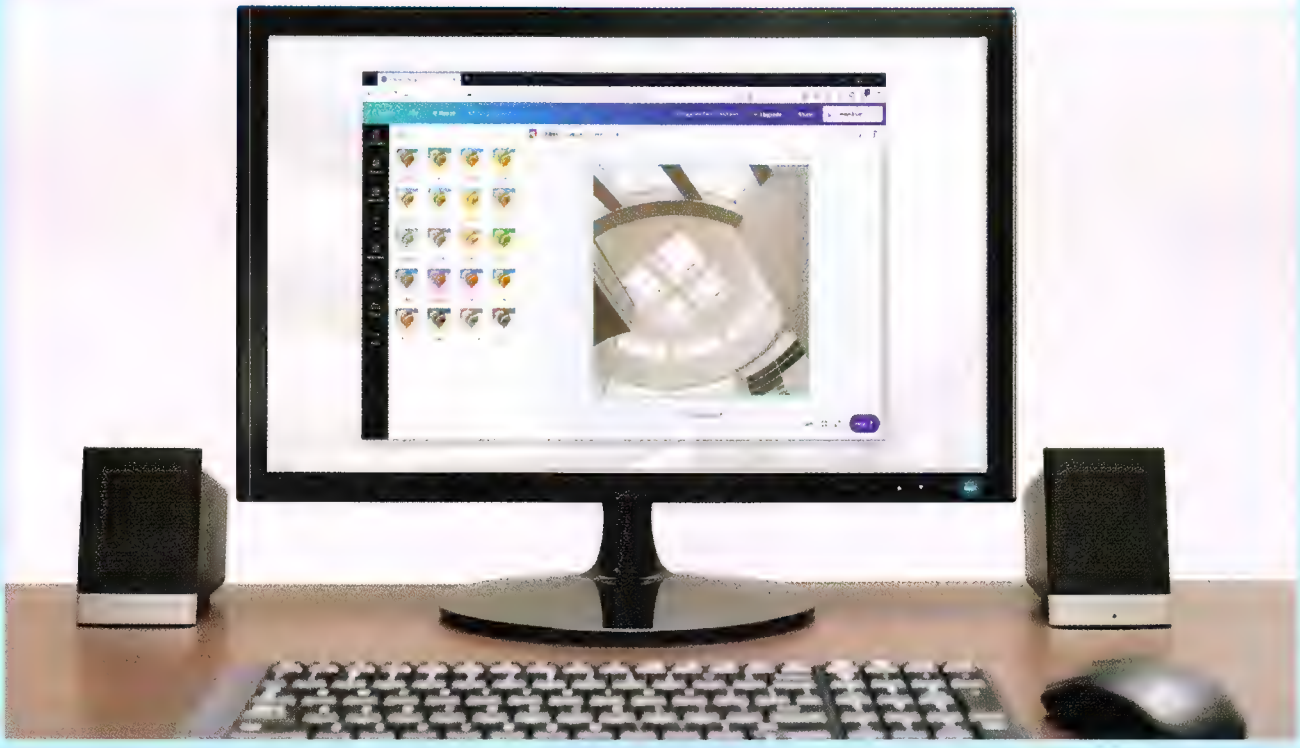
**FREE | WWW.ASHAMPOO.COM**



If you've got a lot of photos that you need to edit in a hurry, Ashampoo Photo Optimizer 2019 could be the tool for you. Its interface is clean and uncluttered, and utterly devoid of ads (although you'll need to submit an email address before you can start using it).

Importing pictures is a breeze, and once they've been added to the pool, you can select several at once to rotate or mirror, saving you valuable time. You can also choose individual photos to enhance with the software's one-click optimisation tool. In our tests this worked particularly well on landscapes, but wasn't always great for other subjects.

If you want to make manual color and exposure corrections, there are half a dozen sliders to let you do exactly that. It's a shame you can't also apply the same color changes to a whole set of pictures at once, but this is otherwise a brilliant free photo editor for quick corrections.



## Canva

Browser-based basics.

**FREE | WWW.CANVA.COM**

Canva is a photo editor that runs in your web browser, and is ideal for turning your favorite snaps into cards, posters, invitations and social media posts. If you're interested in maintaining a polished online presence, it's the perfect tool for you.

Canva has two tiers, free and paid, but the free level is perfect for home users. Just sign up with your email address and you'll get 1GB free cloud storage for your snaps and designs, 8,000 templates to use and edit, and two folders to keep your work organised.

You won't find advanced tools like clone brushes and smart selectors here, but there's a set of handy sliders for applying tints, vignette effects, sharpening, adjusting brightness, saturation and contrast, and much more. The text editing tools are intuitive, and there's a great selection of backgrounds and other graphics to complete your designs.

## Fotor

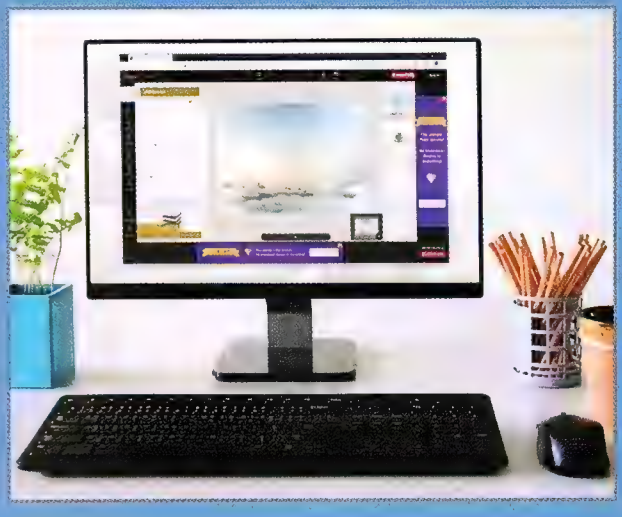
Batch processing FTW!

**FREE | WWW.FOTOR.COM**

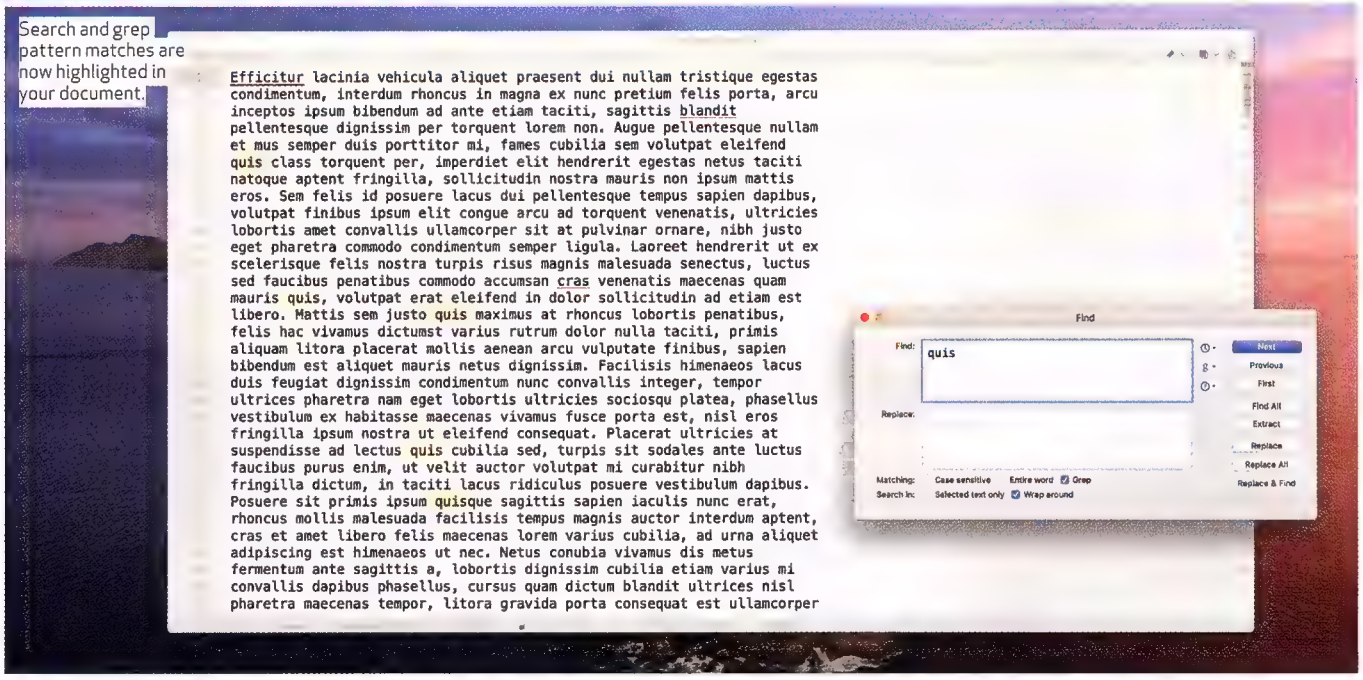
Fotor is a free photo editor that's ideal for giving your pictures a boost quickly. If there's specific area of retouching you need doing with, say, the clone brush or healing tool, you're out of luck.

There's a foolproof tilt-shift tool, for example, and a raft of vintage and vibrant colour tweaks, all easily accessed through Fotor's clever menu system. You can manually alter your own curves and levels, too, but without the complexity of high-end tools.

Fotor's standout function, and one that's sorely lacking in many free photo editors, is its batch processing tool – feed it a pile of pics and it'll filter the lot of them in one go, perfect if you have a memory card full of holiday snaps and need to cover up the results of a dodgy camera or shaky hand.



# Mac » APPS




# BBEdit 13

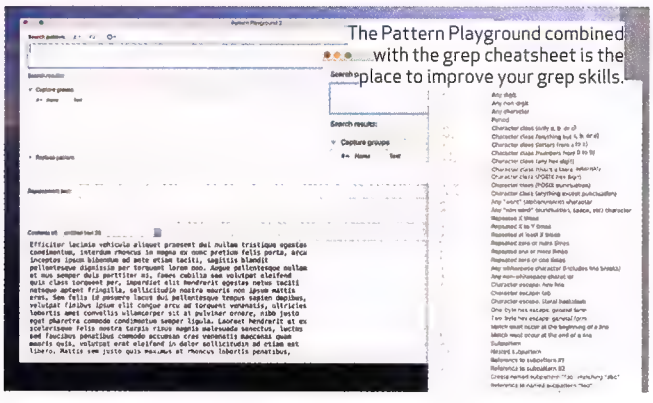
## The Mac's best text editor gets even better.

**FREE (OFFERS IN-APP PURCHASES) | BAREBONES.COM | NEEDS MACOS 10.14.2 OR LATER**

Do some word association about BBEdit, and terms like 'powerful' and 'flexible' spring to mind. After all, this is a hugely capable app for manipulating text and code in a variety of languages. It's packed with features, and its preferences pane has so many options it has a search field.

BBEdit 13, though, follows BBEdit 12.5 in emphasising accessibility – in the sense of unlocking the app's power. The older release debuted a Lorem Ipsum generator and the Commands command – effectively a BBEdit-specific Spotlight that gives keyboard-based access to menu commands like clippings and open files.

The latest update further boosts productivity by way of entry points into powerful find-and-replace functions, and the grep system used to pattern match in plain text documents. So you'll now spot the Find window live-match terms and grep patterns with the contents of the front-most document. For grep, this lets you know if your pattern works, removing trial and error. Additionally, a new cheat sheet lives in the window, so you can quickly check frequently used idioms.

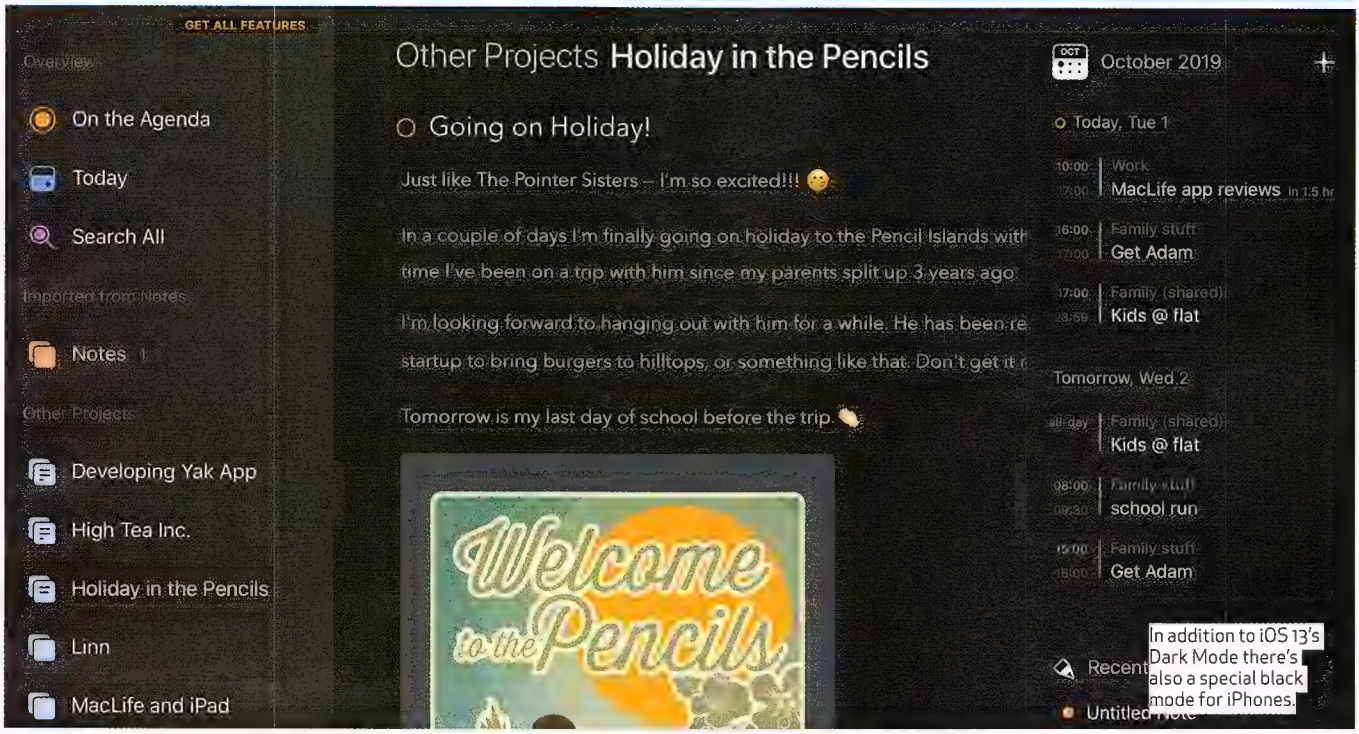

The Pattern Playground combined with the grep cheatsheet is the place to improve your grep skills.

The Pattern Playground is a sandbox in which to experiment with advanced text manipulation techniques. This is particularly ideal for grep newcomers, but also great for experienced types who want to try something new without risk.

### GRAB BAG OF TWEAKS

You also get the usual grab bag of tweaks. Dark Mode can align with macOS Catalina appearance preferences (alongside existing functionality to set bespoke schemes for Light and Dark modes). You can rearrange items in the sidebar, and there's a simplified text transform. And for when you want to dig into update minutiae, you can head to Change Notes in the Help menu.

BBEdit on Catalina also replaces discontinued 32-bit app TextWrangler. Fans of that product might expect a jolt, but instead there are lots of extra features; BBEdit will even bring over your old settings and data. As a free download, the improved replacement of TextWrangler is very generous. For paying customers, the full feature set might feel like more of the same, but that 'same' is excellent. **Craig Grannell**


GET ALL FEATURES
Overview
On the Agenda
Today
Search All
Imported from Notes
Notes
Other Projects
Developing Yak App
High Tea Inc.
Holiday in the Pencils
Linn
MacLife and iPad
Other Projects Holiday in the Pencils
Going on Holiday!
Just like The Pointer Sisters – I'm so excited!!!
In a couple of days I'm finally going on holiday to the Pencil Islands with
time I've been on a trip with him since my parents split up 3 years ago
I'm looking forward to hanging out with him for a while. He has been re
startup to bring burgers to hilltops, or something like that. Don't get it r
Tomorrow is my last day of school before the trip.
Welcome to the Pencils
October 2019
Today, Tue 1
Work
MacLife app reviews
Family stuff
Get Adam
Family (shared)
Kids @ flat
Tomorrow, Wed 2
Family (shared)
Kids @ flat
school run
Family stuff
Get Adam
Recent
In addition to iOS 13's Dark Mode there's also a special black mode for iPhones.

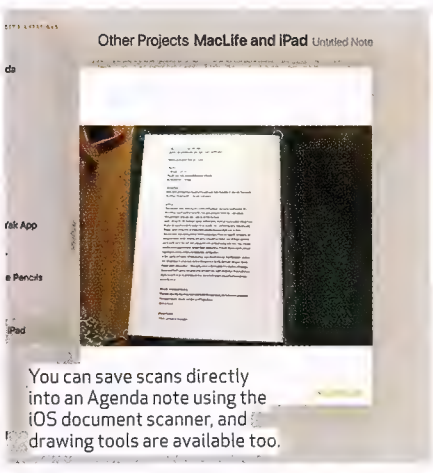
# Agenda 8

## Get organised the easy way.

**FREE (IN-APP PURCHASES) | AGENDA.COM**
**NEEDS IOS 11 OR LATER**

Agenda for iOS takes Notes, Calendar and Reminders, and makes them even better.

Like its desktop sibling it enables you to organise your notes into categories and projects; to assign them to dates in the past, present, or future; and to see what's coming up on your agenda. And like the desktop version, almost all of its key features are free. The premium version beefs up the Calendar and Reminders integration, adds more export options, and gives you some more customisation options.




You can save scans directly into an Agenda note using the iOS document scanner, and drawing tools are available too.

This eighth incarnation of the iOS app boasts three key new features: drawing tools, document scanning, and Dark Mode support – with an additional black theme for OLED displays. The first of the three brings you the same drawing tools you'll find in Apple's Notes app, enabling you to add illustrations and handwritten notes to your typed text. Apple's tools were clearly designed for Apple Pencil: while you can also use a cheap stylus or your finger, the results won't be as good.

### SCAN AND SYNC

The iOS document scanner works very well, enabling you to capture and save documents directly into a note. The image quality is exceptionally good, especially on more recent iPhones, with even very small print captured clearly. It doesn't do OCR, however, and the iOS scanner doesn't currently operate if you're using your app in Split View. It's best suited for little things like business cards or receipts.

The app syncs reliably with its desktop companion via iCloud or Dropbox, and its share sheet enables you to export in formatted text, PDF, plain text, or Agenda's own file format. Subscribers also get an option to export in Markdown.

Agenda's tagging, markup, and organisation features mean it's great for power users, and the ability to scribble or scan directly into a note is useful for grabbing ideas or images on the move. The lack of collaboration features means that it isn't designed for team environments, but it's excellent for individuals.

**Carrie Marshall**

Windows 7 has now been officially retired, so it's time to join Jonni Bidwell as he leads you away to alternative Linux utopia...

# ESCAPE WINDOWS

In April 2014 Windows XP, loved by some, a thorn in the side of others, went End of Life (EOL). There would be no more bug fixes, and no more security updates. Anyone who continued to use it was on their own.

Users had the choice of updating to the newly released Windows 8.1 (though its Metro interface was unpopular and its system requirements were considerably higher than XP's) or 2007's Windows 7, which we can rightly describe as the least worst Windows release of the last 20 years. At the same time, Ubuntu 14.04 had just been released, and back then we reminded people that there was another way. And that way was Linux.

And here we are, with exactly the same advice again. This time around it's Windows 7's turn to retire, and Microsoft would dearly love for you to switch to Windows 10. If, however, you feel that Windows is not the right OS for your needs we're going to persuade you that this is the new OS you and your hardware deserve.

Windows 10's official minimum requirements may be relatively low, and migrating to it from Windows 7 is probably painless. But the same cannot be said for users' first experiences of it: see your desktop transformed into a marketing space. Have your work interrupted by lengthy updates. Share your private data. Be forced into discourse with Cortana when you just want to open an app.

So if you're running Windows 7 and dreading the move to Microsoft's latest system, fear not. And if you're already running Windows 10, it doesn't have to be this way. Thanks to Pop!_OS, running Linux needn't be all cryptic terminals and gobbledygook. It can be easy, fun and involve onomatopoeia.

# A Pop-ular uprising

## Pop!_OS from System76 will challenge your notions of punctuation and shatter myths about Linux being exclusively for the technorati.

There was a time when just using Linux required a superhuman intellect and possibly alliances with dark wizards in order to avoid catastrophe – and installing it even more so. If you didn't have these, it wasn't all that much use as a desktop operating system because there wasn't much in the way of desktop software (in the sense of fully featured apps), and it broke all the time. Windows wasn't much better, of course, but for some reason people accepted it. Perhaps because it ran Microsoft Office.

Fast forward 20 years and things couldn't be more different. Okay, there's still no Microsoft Office or Adobe Photoshop (more on running Windows apps later), and you still can't lay out a premium-quality magazine that stands the test of time with Linux (obscure burn – *Ed*). However, you can happily do all your day-to-day computing there. So if you're facing the Windows 7 end of days and looking for something that isn't Windows 10, we have that thing. It is Pop!_OS.

System76 is a US-based manufacturer of Linux desktops and laptops, which up until quite recently was not a particularly crowded area to be in. As kernel big gun Greg Kroah-Hartman noted in an interview, Linux is serious enough that Dell will happily ship you a laptop with Ubuntu on it. That's what System76 used to do, but being a creative bunch, they wanted to do more. So they developed their own Ubuntu-based OS, and it's really quite fabulous.

A default desktop for Pop!_OS

We asked System76's happiness manager Emma Marshall why people should consider making Pop!_OS their digital home. She replied, "Pop is great for new Linux users because it's not overwhelming [and features a] lightweight design that stays out of the way". Frankly, we couldn't agree more. "If you think about what the use case is for a lot of people, it's web browsing, word processing and creating content. Pop has Firefox built in, which is a user-friendly web browser that some Windows users may have used before. Word processing with LibreOffice is built in as well. And it's free!"

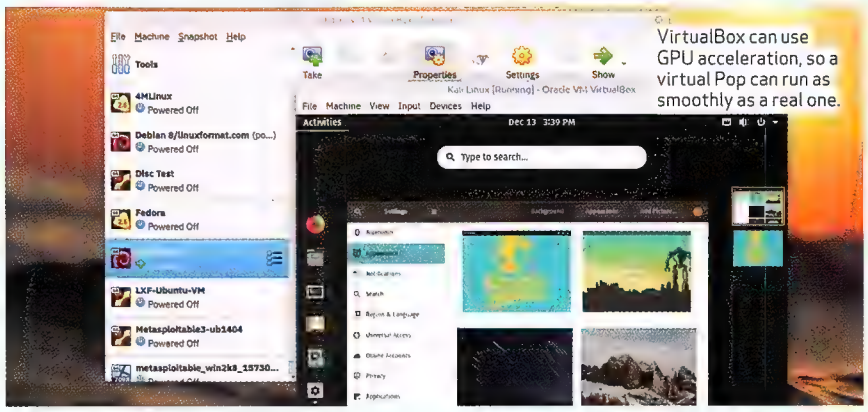
So that's your bread and butter computing sorted. But what about personality? Once again Emma has the answers: "Pop feels more at home because there's less invasive and bossy software. There aren't 50 virus program notifications to dismiss every few hours, there aren't activation keys and physical software packages that need to be bought in order to get things to work. Pop feels much less corporate and robotic".

## Be popping Linux in minutes

We heartily recommend playing in the live environment before installing Pop!_OS. Your starting point is the official site at **https://system76.com/pop** for downloads. Try Demo Mode from the installer (this option appears after you've selected your language, etc.). You can get a feel for how Pop!_OS works and can even add software to it.

There's a small caveat though: you may run into boot problems if you have very new Nvidia graphics hardware, or very obscure Nvidia graphics. In this case you'll want to grab the Nvidia flavoured Pop!_OS ISO from **https://system76.com/pop**. The vanilla version includes the open source Nouveau driver (as well as FOSS drivers for AMD and Intel hardware), which is fine for desktop usage and has great hardware support. For gaming though, you'll want Nvidia's proprietary driver.

Another risk-free option is to install Pop!_OS in a virtual machine, which will enable you to play around with it from the comfort of your current operating system. And if it breaks it doesn't matter, just make another virtual machine, and consider not repeating what caused the breakage last time.



VirtualBox can use GPU acceleration, so a virtual Pop can run as smoothly as a real one.

# Prepare for installation

Back up your files, think about where Linux is going to go, and don't be too quick to delete all trace of other OSes.

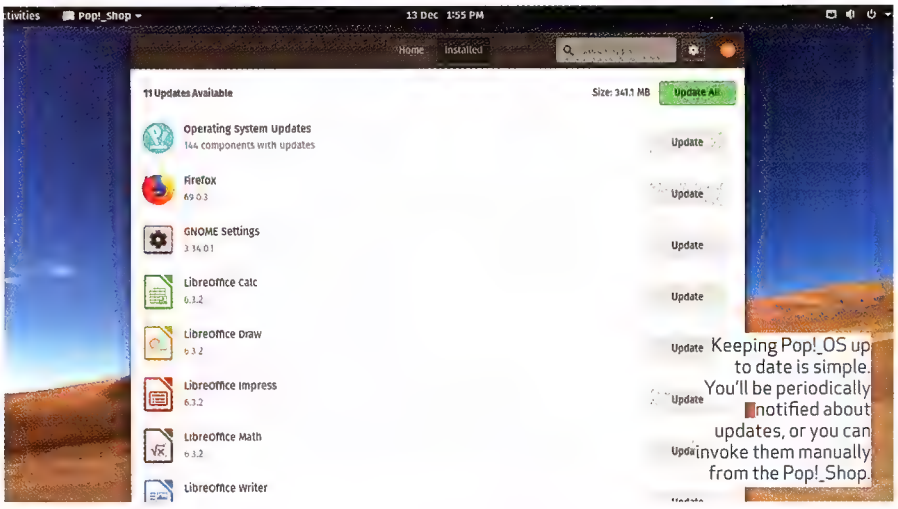
Since very early in the history of Linux, people who wanted access to both Linux and Windows had the option of installing both OSes on a single drive. This dual boot arrangement would start with a Windows install, resize the main Windows partition, install Linux, and then GRUB (Linux's Grand Unified Bootloader) would give you a nice menu where you could choose Windows or Linux.

In theory this should still work well nowadays, but since Windows 8, Microsoft's boot manager and recovery partition structure have become much more complicated. And sometimes it all goes wrong. This might be GRUB failing to install correctly (which could deny the user access to both Linux and Windows), or it could be GRUB failing to get the parameters correct for Windows, making it unbootable. Sadly it tends to be beginners that get bitten by these sort of catastrophic failures, and while bootloader issues don't damage the rest of the data on the machine, panicked attempts to reinstall Windows, or to delete Linux, certainly do.

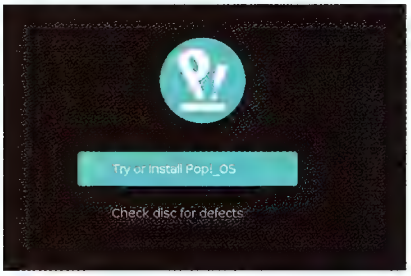
Even if the initial Linux install goes smoothly, we've heard anecdotal reports of things falling apart after a Windows update. This process is particularly opaque and has (reportedly) tried to put new recovery partitions where they don't belong, overwrite GRUB, or otherwise make the system less useful than it used to be. We must stress that these are minority reports – people dual boot Windows and Linux all the time without issue – we just don't want you blaming us if it breaks.

Also, it's not strictly fair to blame Windows for breaking things – it's not exactly designed to live alongside other OSes, and OEMs introduce their own recovery partitions, which may confuse Linux installers and Windows Update alike. Newer GPT formatted disks allow many more than the three primary partitions provided by the old, so-called MS-DOS partitioning (and it also saves you messing around with logical partitions inside those primary ones). But just because you can have more partitions doesn't mean you should.

Our recommendation for users wanting to dual boot without hassle is simple – get another disk drive. SSDs are cheap, easy to install and much faster than hard drives. You'll have more space and you won't have to begin your Linux journey with a potentially risky and time-consuming partition shrink. We don't guarantee your transition to Linux will be hassle-free. But at least this way




## Installing POP!_OS




**1 BACK UP AND BOOT**

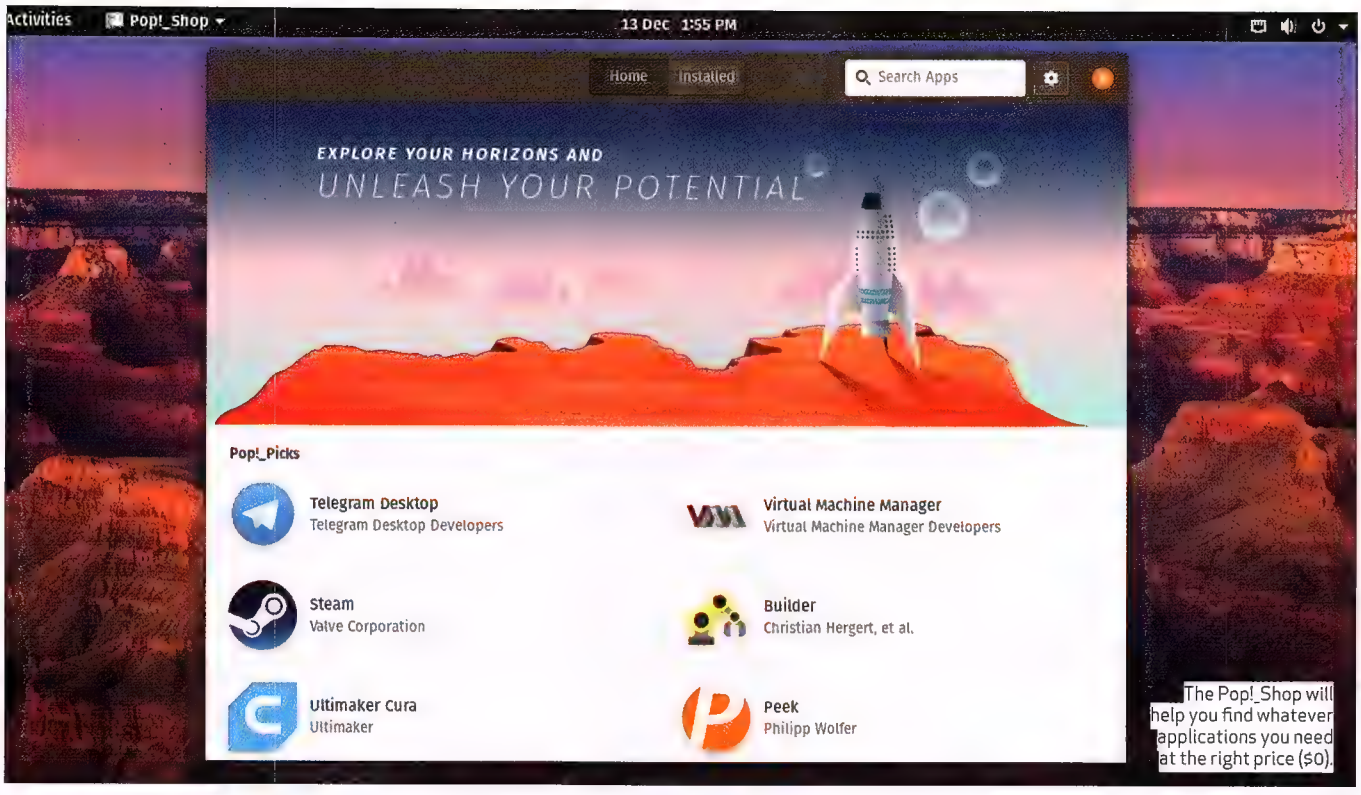
This won't be touching your Windows install, but backing up is a good call. Write the Pop!_OS ISO file to a USB stick and boot that. Your BIOS may require some persuasion to boot from another device – often pressing F10 or F12 will give you a handy boot menu.

**2 LOCALISE**

Choose your language, keyboard layout and location. Select the Clean install option if you're following our sage advice and installing Pop!_OS on its own device (or use the Custom option if you want to sort out your own partitioning arrangement). Select the drive that you're going to wipe and hit the big red Erase And Install button.

**3 INSTALL**

If you want drive encryption, enter a passphrase now. The install should be swift and without issue, but if it doesn't, take a note of any error messages and check out the information this thread on Pop!_Planet: **http://bit.ly/LXFpopplanet**, and indeed the rest of that website, where the Pop community shares news and ideas.



The Pop!_Shop will help you find whatever applications you need at the right price ($0).

your chance of running into any unexpected blank screens or data loss will be diminished. Even if you're migrating a laptop that only has room for one drive, take the old one out and keep it somewhere safe. Get an external drive caddy, so you can get the data off it via USB (or eSATA if you're feeling wild and crazy).

Older BIOS-based systems can be told to boot from a particular device. Newer, UEFI-based machines have a similar option, but it's actually more granular – it can boot a particular OS on a particular drive (see below). UEFI also provides a classic BIOS mode (sometimes called CSM), which you shouldn't need to use, but if your previous install uses this then you should to keep it enabled. A machine can't boot UEFI images in classic BIOS mode, and vice versa. So if you install Linux in a different mode than Windows was installed, you'll need to revert to that mode in order to access Windows again.

It's not recommended to mix and match these things, but sometimes needs must. If you are still nursing a Windows 7 install, it will almost certainly have been installed in classic BIOS mode. If you have a machine made after around 2012, it will almost certainly have UEFI firmware. Whichever you have, by giving your Linux install its own drive and keeping it separate from Windows, life should be easier. You should always be able to choose one or other OS from the BIOS/UEFI no matter what peculiar behaviour either OS exhibits.

Once you've got Linux installed, found suitable alternatives for your Windows-only applications and migrated your data, you can remove the old drive, reuse it, destroy it or use it as a sentimental paperweight.

One thing that distinguishes Pop from other user-oriented distros is that it offers hassle-free full disk encryption. This can be done on other distros, but it may be fiendishly tricky. With Pop all you need to do is tick a box during installation. Encryption (with a strong passphrase) will protect your data in the event of your computer or disk drive being stolen (it does nothing for security once you're logged in). There's no discernible performance penalty, so we'd definitely recommend this option for laptop users. For desktop use (unless you're handling very sensitive data or are very worried about being burglarised) it's a harder sell. A small downside is that if you encounter a disk error (unlikely because Linux filesystems are resilient and you bought a shiny new SSD just for this feature, right?) then there's a risk your data could be corrupted. You should always back up your data so this may not be as disastrous as it sounds.

When you're ready, follow our easy step-by-step guide to getting Pop installed. If you run into difficulties, take note of any errors, check the Pop!_OS community (**https://system76.com/pop/community**) and chat.

## Booting drives

UEFI, the modern replacement for the BIOS, should make things much cleaner. Instead of relying on a Master Boot Record to point to a bootloader on a disk (you can't fit a whole one in the 440 bytes provided), UEFI uses a FAT32 partition to store EFI images to do much the same thing. There should only ever be one such partition (even if you have multiple drives), and as OSes are installed they can add their own EFI images to this partition. Which OS to boot can be selected from the UEFI interface, so there should no longer be any issues with one OS depriving you of access to others, even if they're located on the same drive.

When it first appeared, UEFI was much maligned, in part because it allows Secure Boot, which can restrict which OSes (or even kernels) can be booted. This is actually a good thing, as it can prevent rootkits and so on, and if you want to get your hands dirty you can even use it to only boot your own signed kernel images. But (unless you know where to turn it off) it can also prevent you booting a non-Windows OS. You'll need to disable Secure Boot to boot the Pop!_OS ISO file, although some distros do support it. Unfortunately despite being an open standard (albeit a very complicated one) manufacturers sometimes produce buggy UEFI implementations that get as confused as the BIOSes they superseded. Fortunately, there are tools that can fix broken boots, such as Rescatux (**www.supergrubdisk.org/rescatux/**) – a whole distro dedicated to fixing things.

# Getting to know Pop!_OS

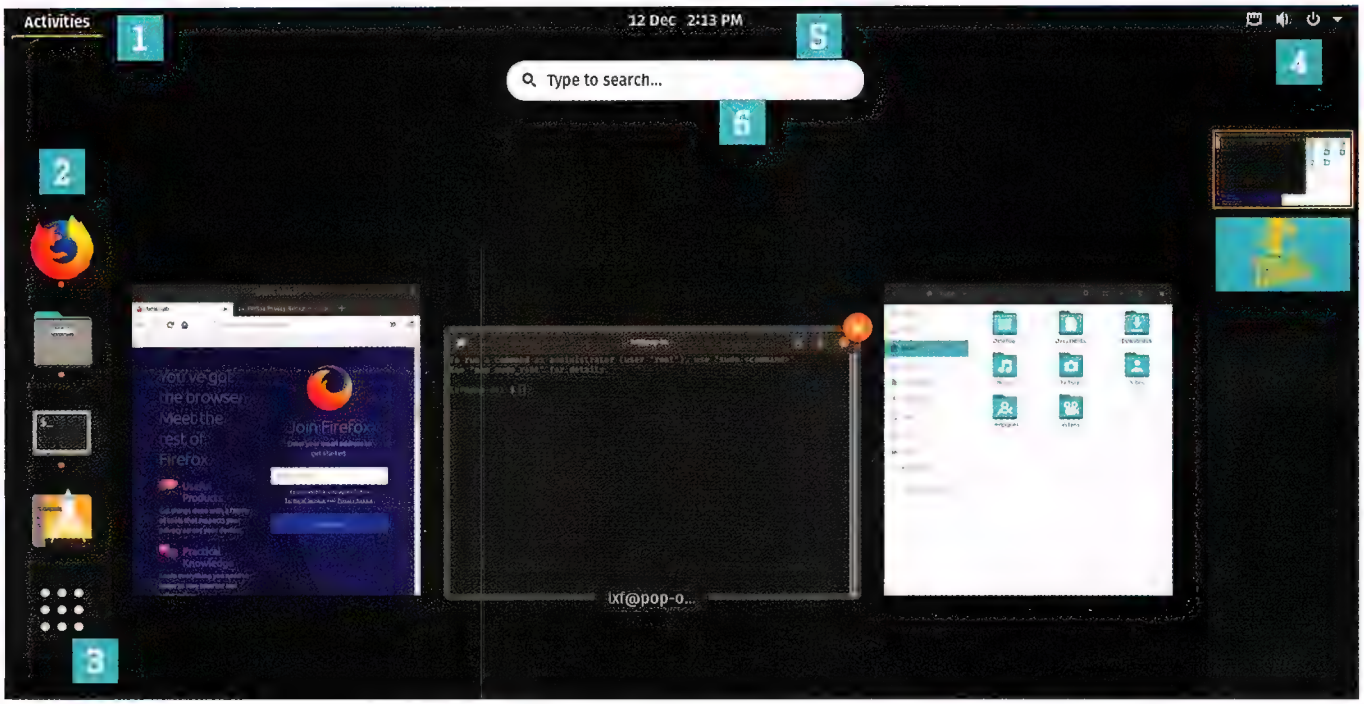
## Don't be daunted, Pop wants you to feel at home and so do we. Explore and enjoy your freshly installed OS.

Once you've rebooted into your new OS, you'll be prompted to connect any online accounts to your Pop!_OS desktop. This can, for example, allow you to access your Google Drive documents from the file manager, receive Facebook and Instagram notifications on the desktop (we don't know why anyone would want to do this), or connect your email accounts. Pop!_OS uses the Gnome desktop (albeit with its own stylings and flourishes), which is quite different to Windows, or indeed many other desktops. However, it's still pretty easy to find your way around once you get used to things such as the lack of taskbar (and also no minimise window buttons) and maybe learn some keyboard shortcuts. It's also thoroughly customisable through extensions, but we recommend getting used to things before trying to change them. The annotation below will help.

Much of our work is carried out online now, so in that sense switching operating systems isn't so daunting as long as you can launch a web browser. You'll find Firefox preinstalled, or you can install other browsers (such as the Chrome's open source cousin Chromium) from the Pop!_Shop. And if you really need Microsoft Office, then you can use the Office365 web apps. We think you'll find the bundled LibreOffice suite just fine. *APC* has migrated to it, in fact.

Open the file manager (imaginatively entitled Files). You'll see that the folder structure is quite similar to Windows too, with Documents, Downloads and folders for your media. You can also find fixed and removable drives listed here, so if you still have your Windows drive installed, you can copy across any files you need. You'll be prompted for a

### GET TO KNOW THE POP_OS! Quick Start




**1 ACTIVITIES**
Click here, press the Super (Windows) key, or just send the cursor purposefully to the top-left to bring up the activities view. From here you can see open applications and switch between them.

**2 SHORTCUTS**
This shows frequently used and currently open (denoted by a dot) applications. You can pin an open application to the shortcut bar by right-clicking and selecting Add To Favourites.

**3 SHOW APPLICATIONS**
Click here to see all of the applications that you currently have installed. You can create folders to group any applications together simply by dragging icons on top of one another.

**4 SETTINGS**
Clicking here will open a menu where you can control audio volumes, select networks (including VPNs), as well as log out of and shut down the machine.

**5 CALENDAR**
Click to reveal a handy calendar and weather applet. If you connect your Google or Exchange accounts (via Online Accounts in Settings), your appointments will show up here.

**6 SEARCH**
Type a few letters of your favourite application (you don't even need to click the box), or even part of a file name, and suggestions will appear here. Hit Enter to open the first suggestion.

password to access internal drives – this is the password you used to log into Pop with, not your Windows password or anything.

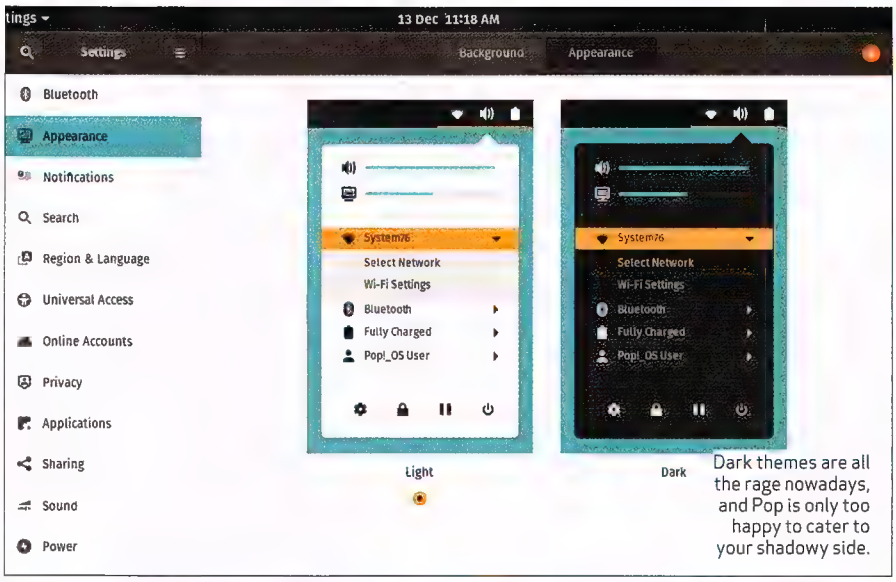
## KEYBOARD SHORTCUTS

One day, dear reader, you will do all your work at the command line and edit all your documents with Vim. When that day comes you will be a ninja of keyboard shortcuts, regexs and other such voodoo. So why not get ahead and start the journey now by learning some tricks that will help you navigate Pop!_OS more fluidly. We've already told you that Super (Windows) summons the activities menu, but here are some other super-handy combos:

- Super-Tab: Switch windows
- Super-Up/Down: Switch workspace
- Ctrl-Super-Left/Right: Tile active window
- Super-Drag: Move window (no need to drag by
- the titlebar)
- Super-Right-drag: Resize window
- Ctrl Shift Alt R: Start/stop screen recorder
- Ctrl Super 8: Toggle screen magnifier
- Alt Super +/-: Zoom in/out (while magnifier is active)

There's a whole bunch more that you can find at **https://pop.system76.com/docs/keyboard-shortcuts/**.

Pop comes with everything 'most' people need to get started with their digital tasks. But we know you're not most people, and we know that you have your own tools and workflow that you're eager to incorporate into glorious Pop!_OS. There's a whole raft of free software available in the Pop!_Shop, which you should not hesitate to peruse. The Windows way of installing software (downloading random binaries from the web) is not the normal practice on Linux. Instead distros maintain their own repositories, which allows some amount of quality assurance (you can add custom ones, and if you really want to download random binaries you can do that too).




Dark themes are all the rage nowadays, and Pop is only too happy to cater to your shadowy side.

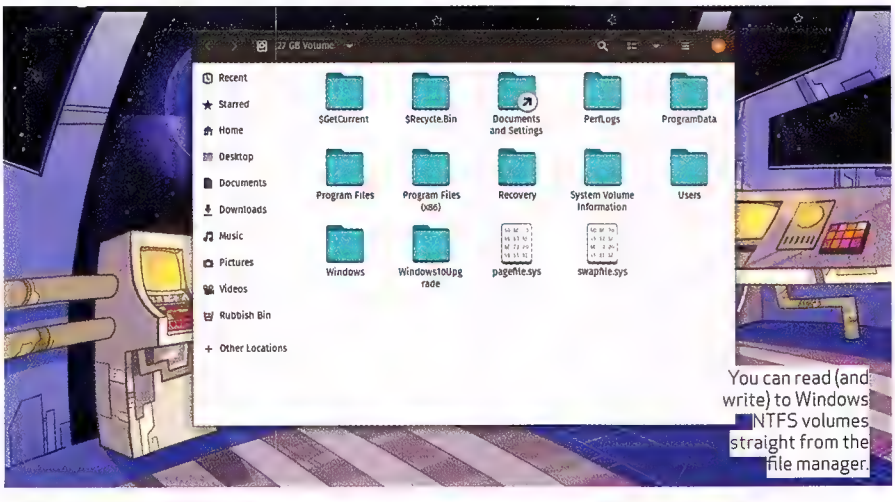
> "We can run thousands of Windows-only titles with a minimum of fuss. A ton of titles have already been whitelisted and are available immediately."

## ALL THE GAMES

Gaming on Linux is pretty exciting nowadays. Not only do we have the Steam client (that's available in the Pop!_Shop), Steam Controller support and several wonderful Linux ports of AAA games (such as *Shadow of The Tomb Raider*, ported by Feral Interactive), but thanks to Proton (Valve's compatibility layer) we can run thousands of Windows-only titles with a minimum of fuss. A ton of titles have already been whitelisted and are available immediately from the Steam store (check out **www.protondb.com** for some stats), but if you want to try it on other titles you can do so from the Steam client by going to Steam > Settings > Steam Play and ticking Enable Steam Play For All Other Titles box. You can also choose between Proton versions (beta versions are sometimes available), in case that helps matters in any way. Any Windows titles you own will magically become launchable now, and you'll see a note declaring that they will be run via Steam Play on the library page.

Not everyone likes proprietary ecosystems like Steam, though. And we are well aware that there were games long before Steam. So another solution for running Windows games is Lutris (**https://lutris.net**), which you'll also find in the Pop!_Shop. Lutris can run DRM-free games, such as you would find at GOG or The Humble Store, as well as some DRMed titles from Steam, Origin, Uplay and more. Epic Games (whose store also works via Lutris) recently awarded Lutris an Epic MegaGrant to help them improve the experience. Sadly this won't mean you can play *Fortnite* on Linux anytime soon.

Both Lutris and Steam Play rely on a tool called Wine (which used to be an acronym for Wine Isn't an Emulator. Don't ask) that has been around since the early Linux days. You can download Wine independently of these things, and use it to try and run any Windows application at all (some will work, some will not). This is a whole feature in itself, and you'll need to get to grips with the terminal before you can do this.




You can read (and write) to Windows NTFS volumes straight from the file manager.

# Unique to Pop

Ubuntu derivatives are ten a penny, but Pop!_OS brings a shedload of innovations and a commitment to community.

For a long time, Ubuntu was the gold standard for beginner distros. It's still a great choice, but over the years there have been decisions (some of which have been undone) that have caused consternation among the community. Pop, while still being an Ubuntu-based OS, differs from its progenitor in a few key areas.

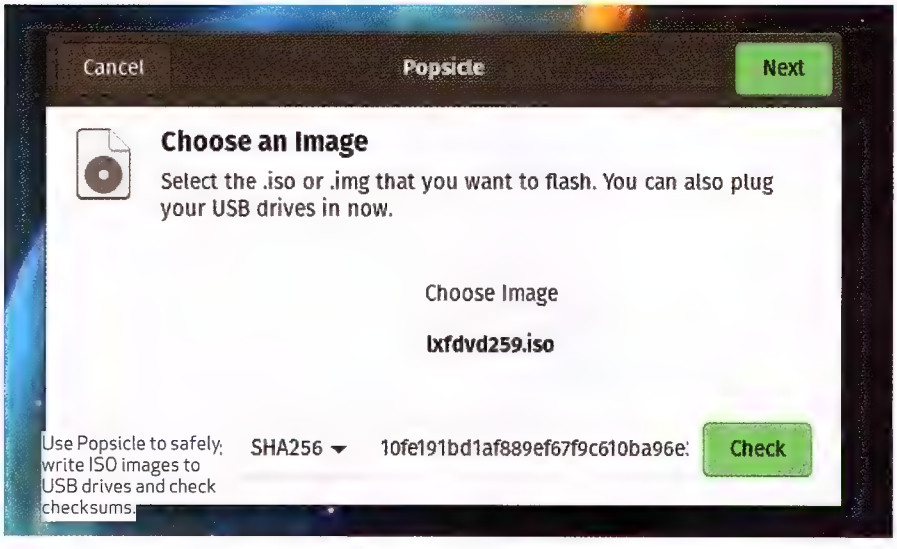
Perhaps the most relevant today is that it doesn't use Wayland, the new graphics protocol the Gnome desktop environment has been championing. Pop sticks with the tried and tested X.org display server for now. The people at Pop are "evaluating [Wayland's] readiness" and will offer it when they feel it's worthy of their users.

Another key difference is the Pop!_ Shop, which replaces Ubuntu's Software tool. Apart from the user-facing differences, behind the scenes lies Pop's decision to avoid the Snap packaging format (and the proprietary Snapcraft store), which is starting to proliferate the Ubuntu ecosystem. New packaging formats offer some advantages, particularly for developers who want their software to be available without the need to wait on individual distros to update their repos and package it for them. However, there are alternatives (such as Flatpak), and we also still quite like traditional packaging.

Pop also doesn't collect information about user installations. From version 18.04 Ubuntu started collecting anonymised data about user installations by default – though the data is no doubt useful (you can see some at **https://ubuntu.com/desktop/statistics**),

If you've ever heard anyone ever talk about Linux problems at least one of them probably mentioned Grub – the bootloader used by most Linux distributions. Heck, we mentioned it several times at the beginning of this feature. It may please you to hear, then, that Pop doesn't use Grub, but rather uses the lighter and faster systemd-boot. We could, but won't, talk for many pages about systemd's popularity. Instead we'll just say (quite accurately) that you won't ever have GRUB problems with a typical Pop!_OS install, and hope you don't have bootloader problems generally.

> "Pop comes with the cutely named Popsicle, which is a graphical tool that makes it much more difficult to write images to the wrong device."



Use Popsicle to safely write ISO images to USB drives and check checksums.

Another common cause of Linux consternation (particularly when you get a taste for distro-hopping) is having to write distro ISO files to USB sticks. The most reliable way to do this has always been at the command line (with the dd tool), but this has the downside that if you get a device name wrong you can wipe out a whole disk's worth of data. Pop comes with the cutely named Popsicle, which is a graphical tool that makes it much more difficult to write images to the wrong device.

You may, in the distant past, have had the pleasure of upgrading your BIOS, either through some overblown Windows tool or the old-school way with a bootable floppy and a DOS utility. Modern UEFI firmware can be upgraded by downloading a file onto a USB stick, and upgrading directly from that interface. But there's an easier way, the LVFS (Linux Vendor Firmware Service) allows updates to be issued from hardware vendors directly to Linux. System76 has made this process even more streamlined through the creation of its own Firmware Manager, which integrates neatly into the Settings panel. So the once-terrifying process of updating the prima materia of your computer can be done in a couple of clicks.

## LOOKING ELSEWHERE

We like Pop!_OS and we hope you like it too, but you might not, and that's okay. There are beginner-friendly alternatives, and a lot of what we've talked about here can be applied to these other Linux distributions. We're really looking forward to Mint 19.3. The beautiful elementaryOS 5.1 was released in early December 2019 and is perfect for those who prefer a macOS-like desktop. The Pop!_Shop is in fact derived from elementaryOS's AppCenter, with the difference that the latter includes paid applications.

If you're looking to replace travel laptops, then it's worth considering Chromebooks. Not everyone wants to support Google, but they are cheap, and having all your data in the cloud has some advantages. ChromeOS is based on Linux, and through the magic of its Crostini VM can run 'proper' Linux applications, besides proprietary distractions such as Netflix.

If you're stuck on 32-bit hardware you still have options (besides Mint). Bodhi is a great one, but it's perhaps not

as user-friendly as the OSes described above. There's also Peppermint, MX Linux and Antix. The most recent Ubuntu LTS (Ubuntu 18.04) was the last to provide 32-bit install media, so the derivatives based on this will be the last of their lineage to do likewise. That's okay, since these distros will be supported until 2023, which in all honesty is a few years past that hardware's best-before date.

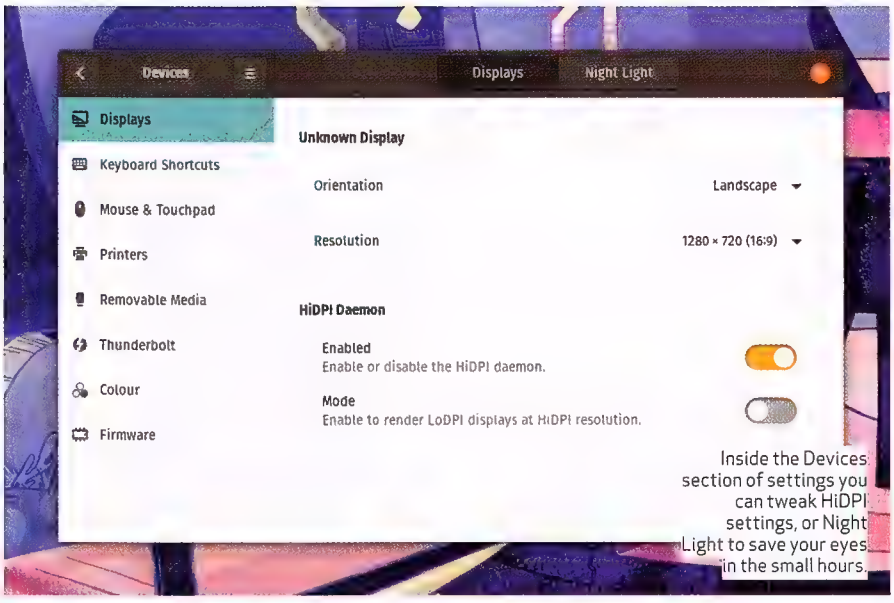
## BEST BEFORE DATE

Microsoft was, all things considered, pretty responsible when the XP EOL date came. It continued to provide malware signatures for its Security Essentials tool for a year after the EOL date. And it's even emitted a few patches for serious flaws (an IE bug just weeks after XP's doomsday, Wannacry in 2017 and BlueKeep in 2019) despite being under no obligation to do so. Most data today suggests all but the most laggardy of laggards have moved on from the two-decade-old XP, its market share across all Windows versions declining from around 20% in 2014 to around 1% today.

However, data (**https://gs.statcounter.com** is a good place) also suggests that just under 30% of current desktop Windows users are still using Windows 7 (Microsoft's heavy-handed forced upgrade tactics notwithstanding). And Windows 7's EOL was 14 January 2020, just a couple of weeks before this magazine is to hit the shelves.

Managing OSes going EOL is not strictly the preserve of proprietary software – it happens in the open source world too. One aspect of Pop_OS! 19.10 we haven't touched on is that it's only supported for nine months (until April 2020). After that a new LTS (long-term support) release, based on Ubuntu 20.04, will be released, which will be supported for five years. Don't worry, the upgrade process will be painless, and it's extremely unlikely that Pop 20.04 will take much design inspiration from Windows 10. System76's happiness champion assures us that "extensive work has gone into the pop-upgrade tool (written in Rust) to ensure that critical packages are retained on an upgrade, making it less error prone." In the meantime, if you really want the current LTS of Pop!_OS then you can grab it from **https://system76.com/pop**.

Canonical issues three intermediate versions of Ubuntu at six monthly intervals, in between its LTS releases. These are used as a staging ground for the developing features that will make it into the more thoroughly tested LTS releases. Ubuntu-based distros may follow just the LTS releases (like ElementaryOS and Mint) or follow the intermediate releases too, like Pop.



Inside the Devices section of settings you can tweak HiDPI settings, or Night Light to save your eyes in the small hours.

The two-yearly LTS releases of Ubuntu (and derivatives such as Pop) are supported for five years (18.04 LTS paid-for support extends this to ten year and it's unclear if everyone will benefit from this or not), so last April saw the venerable Ubuntu 14.04 go End of Life, but not necessarily end of support. Canonical offers paid Extended Security Maintenance for organisations that are still using the old release. Recently, through its Ubuntu Advantage for Infrastructure program, it's allowed personal users to get free ESM support on up to three machines. But most home users at least seem to have happily upgraded away from Trusty Tahr. This is in stark contrast to Windows 7, which even though Microsoft offered (and in some cases tried very hard to force) free upgrades to Windows 10 in 2015, still runs on millions of machines. We think you're one in a million, dear reader, and we hope you enjoyed this feature, and have a great new year and new decade.

## Terminal toe-dipping

If you look on the shortcut bar you'll see a launcher for the Terminal application. This emulates an old-school computer terminal, where in days of yore you'd interface with the machine using abstruse commands typed on a monochrome screen. This way of operating continues to this day, and with good reason – pretty much anything you can do through a graphical program can be done via the terminal, and, if you know the commands, can often be done far more efficiently or automated with scripts.

There was a time when it would be foolhardy to attempt to use Linux without some knowledge of command line incantations, but for regular desktop usage it's no longer a requirement. Still, if you've ever played around with Command Prompt, Powershell or have fond memories of DOS, you'll understand how it works. Here are some basic commands to get you started:

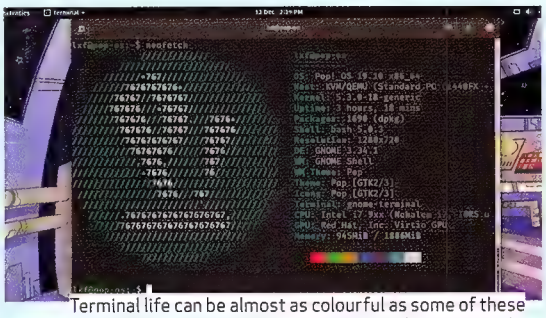
`pwd` Print the full path of the present working directory. Note that Linux separates directories with / instead of \

`ls` List the files in the current directory, add `-l` to see details.

`cd` Change directory. Use this to navigate the filesystem.

One of the most useful features of modern shells is tab completion. Type part of a command or filename, hit Tab twice and you'll see a list of possible completions.

If you want to find out more System76 has provided a great primer on terminal basics at **https://support.system76.com/articles/terminal-basics/**.


Terminal life can be almost as colourful as some of these amazing Pop!_OS backgrounds.

# 2020 TECH PREVIEW

## The APC team predicts what the coming year holds for PC technology.

It's been a pretty wild year for PC technology, and an even wilder decade. This was the decade that brought system building more into the mainstream, and saw PCs rise above the hubbub of consoles and mobile devices to achieve a healthy position in the market and in our hearts.

PC gaming is in a particularly good place, with multiplatform multiplayer more common, and proper gaming hardware getting cheaper. DDR4 memory exploded onto the scene, initially pricey, but now more affordable and higher quality than ever. M.2 SSD took longer to get off the ground, but now it's hard to imagine a high-end rig without one of these high-speed drives.

It's now easier than ever to build yourself a PC. Next-generation integrated graphics allow for inexpensive work systems, while GPUs have improved incrementally to enable truly next-level graphics. Ray tracing also saw a rise in popularity; while Nvidia's RTX cards arrived in 2018, it was in 2019 that the question of ray tracing was truly posed to the industry.

We've been treated – spoiled, even – with sleek, powerful hardware, and it leaves us hopeful for the coming year. 2020 promises plenty, but even more is under wraps. Next-gen CPUs and Intel's entry into the GPU market are exciting prospects, so here's our hot-off-the-press take on what will happen in the tech industry in 2020.

# GRAPHICS
# CHANGING THE STATE OF PLAY

Graphics are due for an exciting year. AMD and Nvidia are squaring up against each other to deliver a new generation of powerful discrete GPUs, but there's a newcomer: Intel, promising to make its GPU debut in 2020 with a new series of cards, currently named the Xe series. While we haven't seen a full lineup announcement yet, at the time of writing, Intel did reveal more about this potentially interesting GPU at CES 2020. Before then we had a few scraps of information. The news of Xe's existence was leaked all the way back in 2018, at which point the given code name was Arctic Sound. Intel was quick to do an official reveal, albeit one lacking any real information on the new GPUs.

Unfortunately for gamers it appears that Intel is designing the Xe-based GPUs for the compute market, which includes supercomputers. So, it's not looking likely it will be a compelling consumer product, although Intel has hinted at new technology that allows discrete and integrated GPUs to work together to improve performance on a system with both installed. Mike Burrows, CTO and Director of Advanced Technologies Group, Gaming & Graphics at Intel, said on Twitter that the discrete variant has the benefit of dedicated memory, dedicated power and better thermals. He also said there are "lots of potential benefits" to having the same graphics architecture integrated on the same CPU side and also as a discrete variant. This could tantalisingly refer to the integrated and discrete graphics working together.

That leaves us with three GPUs with 1,024, 2,048, and 4,096 cores. While Intel's cores won't work in the same way as existing Nvidia technology, like CUDA, we can immediately compare these three cards to three existing GPUs in Nvidia's GeForce lineup: the GTX 1650, RTX 2060, and RTX 2080 Ti. Intel might be firing on all cylinders when it joins the GPU market, with a Xe card for 1080p, 1440p, and 4K respectively.

## STAYING COMPETITIVE

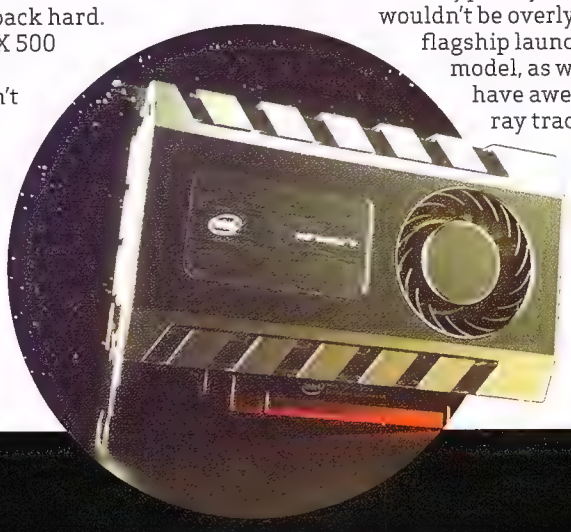
If that's the case, AMD needs to hit back hard. While the new 5600XT plus older RX 500 and 5000 series GPUs are effective 1080p and 1440p solutions, AMD isn't offering a high-end desktop GPU right now. The Radeon VIII might pack tons of VRAM, but it isn't competitive with the likes of the RTX 2080 Ti and 2080 Super, especially not in gaming terms. If Intel pushes a powerful, expensive GPU right out of the gate, AMD risks losing its stake in the high-end slice of the market.

Perhaps that wouldn't be such a bad thing, though. AMD's RX 580 and 590 GPUs might no longer be in production, but they're still readily available at low prices, and still hold up excellently for 1080p gaming. AMD is also pushing out plenty of new 5000-series cards, like the 5300 and 5600, with no sign of a more powerful GPU, such as a theoretical 5900 XT. If AMD decides it wants to focus on the more affordable end of the GPU spectrum, who are we to question that? Cornering the low-end market could be beneficial, and if AMD is the competitor that brings budget 1440p gaming to the masses at the most competitive price point, it might not need to worry about 4K – yet.

Nvidia, on the other hand, almost certainly will be providing a new 4K-viable – possibly even an 8K-viable – GPU in 2020. An RTX 3000 series is what we want to see, and with Intel entering the market, it's what Nvidia needs to release in order to stay relevant. It's too early to speculate on the future of the improved Super cards, but an RTX 3080 would be a great thing to see at Computex this year.

Indicators are that we'll likely see the architecture revealed at Nvidia's GPU Technology Conference in March; our opinion is that it absolutely has to use the 7nm process, likely the Ampere architecture, developed with input from Samsung and TSMC. Speculation that we'd see a major reveal at CES didn't pan out, however the further down the timeline we go, the more likely a major reveal gets; Computex 2020 could well be the place for a major lineup reveal.

Performance isn't likely to be the sticking point of the RTX 3080, or any new GeForce series. It'll be pricing. There's little doubt that a 3080 or 3080 Ti (the latter of which would typically be released later, although we wouldn't be overly surprised to see an early flagship launch of the super-powered Ti model, as we did with the 2080 Ti) will have awesome performance. Improved ray tracing is all but guaranteed, but these GPUs should also show general performance boosts over the 2000-series cards in areas such as rasterisation.



An early image of Intel's Xe GPU, which may not reflect the appearance of the finished product.

Above-left: The 2080 Ti is the high-end champion of Nvidia's current-gen GPUs. Above: *Cyberpunk 2077* is one of a growing number of games that will feature ray-tracing support.

## PRICE PANIC?

When it comes to price, though, Nvidia has a blank cheque and the guts to use it. When the next generation of GeForce cards hits, we fully expect to see ludicrous prices for the high-end consumer cards. An RTX 3080 Ti could very possibly sit in the vicinity of $2,500 or more, and those cards will likely still be the only ray-tracing-enabled cards on the market.

Once Intel arrives and AMD gets its own ray-tracing tech off the ground, those prices will need to drop. Improvements to the RDNA architecture (as will be seen in the newly announced Xbox Series X) means that the next generation of AMD cards will obviously be more powerful, but once ray tracing eventually hits Radeon cards, Nvidia will lose its USP and effectively be forced to lower its prices. Moving forward, we're hoping to see Nvidia bring out real competitors in the mid-range and budget fields, potentially with a card like an RTX 2660, bringing ray tracing to more affordable GPUs in the same way that AMD already plans to.

VRAM is the last big question. We can obviously expect that some of 2020's high-end cards will have crazy amounts of video memory. The 16GB Radeon VII is a year old, and we haven't seen a mainstream GPU with more memory yet (barring a few very expensive workstation cards). Perhaps the more interesting question will be how much memory the mid-range and budget cards are equipped with; 4GB is a low-end standard right now, but it's hard to imagine that will be enough to cut it in the futuristic landscape of the 2020s.

# MAX QUESTIONS

Where are we with laptop GPUs? The Max-Q variants of GTX and RTX cards mean that Nvidia has the market cornered for discrete laptop graphics, retooling existing GPUs with lower thermal power design and quieter operating volumes, typically in exchange for slightly lower clock speeds.

Max-Q models of the newer Super GPUs are nowhere to be seen, although the technology is there. The Super GPUs use existing architecture, which means that adapting them for laptops should be straightforward, but they've yet to be ratified at the time of writing. There's a small chance that Nvidia will skip the Super generation for laptops, going straight for Max-Q versions of its next-generation chips.

There's no news on Intel GPUs in compact formats for laptops, and we're not prepared to speculate; news on the Xe GPUs is thin enough on the ground.

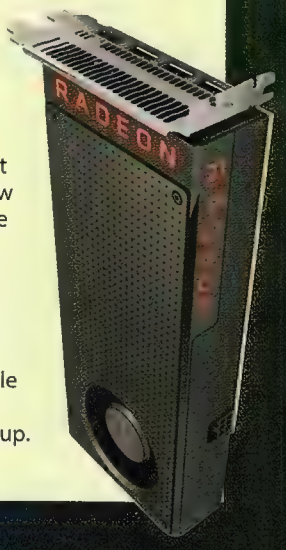
AMD has hit the mobile market in a big way, now, with its Ryzen Mobile 4000 APUs announced at CES 2020. Could AMD take Intel's last bastion? At the same show Asus launched its new year range of several laptops – and every one of them was running Ryzen Mobile 4000 processors – not one had Intel inside! If AMD claims more of the market, we could see a more committed development of discrete laptop GPUs from Nvidia, rather than retooling a few of them for laptop use.

# CHEAP & CHEERFUL

A recent interview with Raja Koduri, senior vice president of core and visual computing at Intel (and former AMD director of graphics architecture) revealed some potentially telling information regarding the upcoming Xe GPUs. He asserted that more expensive cards were still viable. Intel wouldn't need to sell a lot of them to turn a profit.

Koduri alluded to $1,000–$1,500 cards, noting that not everybody would buy them. He argued that Intel's strategy would have to include affordable, mainstream GPUs, saying its range "even started around US$100."

However, AMD has just launched a fierce 1080p card in the form of the 5600XT, and its performance puts it ahead of every Nvidia card in this segment. It's also priced competitively at under $500 and we've got our first review of a Sapphire model in this issue on page 34. Team Green has been struggling at the cheaper end. The GTX 1650 was underwhelming, and while the 1650 Super performed better, it only has 4GB of VRAM, and is closer to $300. We'd like to see Nvidia remember that more people want affordable cards, and produce a budget component to its upcoming lineup.



# PROCESSORS

## THE RACE FOR MORE, FASTER CORES

2019 was a great year for desktop processors. That was mainly thanks to advances in AMD's Ryzen line, not down to anything that Intel was up to, but to be fair, there were some headline-grabbing releases for Big Blue, too (we'll come back to that shortly). The problem for Intel is that 2020 looks like more of the same, with the company playing catch-up to what AMD has already done. Can it compete? Let's dig a little deeper to find out.

Intel's 10th-gen Comet Lake chips are the core of its desktop release strategy this year. These are expected to drop in April, essentially still based on the Skylake architecture, and using the 14nm++ production process. This means that we won't be seeing any revolutionary performance increases due to reworked fundamental design changes, but there is a good chance that we'll see tweaked performance from subtle optimisations of this well-known core.

The big sell for Comet Lake is the number of threads on offer, with the top-end chip, the Core i9-10900K, expected to ship with 10 cores and 20 threads as standard. The Core i7 CPUs will have eight cores, while the Core i5s and Core i3s will have six and four cores respectively. Importantly, all the chips in the Comet Lake family are expected to have Hyper-Threading as standard, doubling the thread count – no marketing-forced changes here, which is a nice step forward. The likes of the Core i5-10600, with six cores and 12 threads, makes for a tasty upgrade from the previous Core i5-9600, for example, especially if the pricing is maintained (however doubtful that is).

Now for the bad news: These new 10th-gen chips will use a new LGA1200 socket, which is the same size as the outgoing LGA1151 socket – so hopefully your CPU cooler should be compatible, even if you do have to buy a new Z490 motherboard. We assume these new pins are needed for the updated core count at the top end, but Intel isn't opposed to subtle tweaks here and there to ensure that its chips aren't backward compatible.

We don't have anything firm in terms of speeds yet, although Intel has shown that it can push this microarchitecture hard, even on the 14nm process. The Core i9-9900KS, which was launched at the end of October 2019, has a base clock of 4GHz (up from 3.4GHz on the 9900K), along with an all-core turbo of 5GHz.

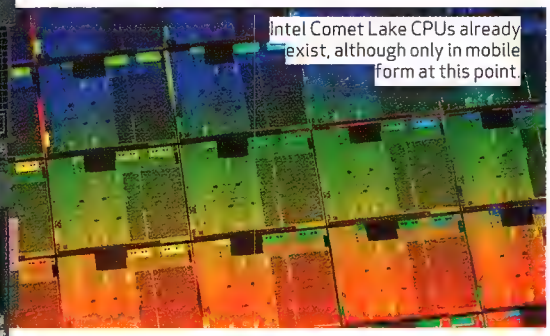
It may be an older process, but Intel's 14nm++ architecture is clearly a known entity and it's doing some impressive work. We can expect a subtle uptick on performance against the existing ninth-gen processors, with bigger improvements anticipated at the top of the stack.

Zen 3 is due, and will use TSMC's 7nm+ production process.

## ARMING AN ALTERNATE FUTURE

ARM has been threatening to take the fight to Intel and AMD for years, and at the end of 2019, we finally saw this take serious shape in the form of the Microsoft Surface Pro X. While not the first time we've seen a Qualcomm-powered solution running Windows, the fact that it came from Microsoft means this probably isn't just a flash in the pan.

The Surface Pro X uses a newly developed processor, the SQ1, that Microsoft co-developed with Qualcomm. This ARM-based chip has an impressively low power draw of just 7W, yet offers three times the performance per watt of the Surface Pro 6. The problem is, 64-bit apps don't currently work with this chip unless they've been recompiled for it; 32-bit apps should work, but apps that call on other services, some of which may have 64-bit dependencies, can undermine this. Most apps and games have not been ported across, though, and you'll find that there are a lot of things that don't currently run. Dropping $1,700 or more on a machine that doesn't run your favorite app can be a problem, but it's early days, and Microsoft will hopefully be able to iron out the problems. This shift to ARM is something that we expect to see more of going forward. While this initial effort from Microsoft is somewhat faltering, it does show an intention to take ownership of the core of its machines – something Apple has been doing with its iPads for some time, with its latest Bionic A12X knocking up comparable numbers to mid-range chips. There is still an expectation that Apple will shift over to a chip of its own creation in its Mac range, too.



Intel Comet Lake CPUs already exist, although only in mobile form at this point.

The good news for Zen 3 is that it's going to be compatible with existing AM4 motherboards.

The Core i9-9900KS proved that there is still life in the aging 14nm++ process.

One thing we don't know at this point is when we'll see something new on the integrated graphics front. We've been impressed by Intel's Iris Plus graphics subsystem, as seen in its mobile Ice Lake chips, but this won't make it to Comet Lake. Intel has tended to push serious gamers toward discrete graphics solutions on the desktop, but there are plenty of uses where integrated is all that's needed. Now we have a fairly established GPU-less set of chips from Intel (chips with the F suffix), it may be that it charges a premium for Iris Plus.

It's worth bearing in mind that while AMD may be winning all the plaudits for general computer work, Intel is still the go-to manufacturer when it comes to pure gaming – there may not be much of a lead, but a few frames' difference here is all that hardened gamers need to warrant their preference. Will this still be the case with Comet Lake? Probably, especially if Intel can keep pushing up the operating frequencies.

### APU ANNOUNCEMENTS

Before Intel gets its Comet Lake game going, AMD is expected to show off its Ryzen 4000 Renoir APUs. These are designed for laptops, an area where AMD has traditionally struggled, and where Intel still holds court. Ryzen 4000 APUs are based on the Zen 2 cores, as opposed to the Zen+ used by Ryzen 3000 APUs, which means they'll have support for PCIe 4.0, as well as improved memory support, and better overall performance.

What about the graphics core? We've been eagerly awaiting the Navi architecture to make its debut in APUs, but it looks as though we're going to have to keep holding our breath on this front, because these new chips are expected to use Vega still. AMD is, of course, producing the chips that will power Microsoft and Sony's next-gen consoles, and they are both expected to employ second-gen Navi cores, so it may be some time before such chips appear in a PC-friendly guise.

What about Zen 3? Dr. Lisa Su, AMD CEO and president, had some good news on this front in a recent interview with *VentureBeat*: "We're well underway with Zen 3 as a follow-on, as well, for 2020." Understood to use Extreme UltraViolet Lithography to improve transistor density and reduce power consumption, the process, which AMD is referring to as 7nm+, produces an improvement to IPC over Zen 2 of 15 percent on average.

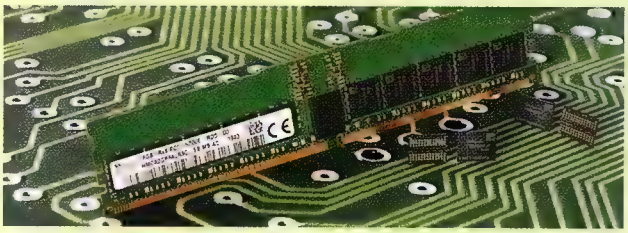
Unlike Intel, AMD is sticking to its existing platform for Zen 3, with its AM4 socket remaining compatible for these new chips. AMD isn't expected to make any changes on this front until Zen 4 drops, some time in 2021.

# WHATEVER HAPPENED TO DDR5?

DDR5: Where did it go? The original blueprints for the next stage of RAM were published by the Joint Electron Device Engineering Council way back in 2017, and while JEDEC had hoped to have the standard for DDR5 released for public use by 2018, as of the time of writing, the details are still being finalised.

The potential performance increases offered by DDR5 are significant. Lower voltage requirements and increased memory speed are some of the improvements here, along with the addition of onboard voltage regulators within each DIMM stick. This would mean that motherboards would no longer require their own voltage regulators for the memory subsystem, although what this means for motherboard and RAM pricing is unclear right now.

Some manufacturers have been eager to show off their early DDR5 models, including Rambus and SK Hynix, but news has been thin on the ground since then. SK Hynix did reveal a fully functioning 6,400MHz chip in early 2019,



but that sort of product seems nowhere near ready to enter the consumer market.

Our prediction is that we'll likely see DDR5 components hit professional servers first, with the reduced voltage being a huge benefit for large-scale server farms. That lower power draw will likely also be attractive for mobile devices, but whether DDR5 will hit those before conventional desktop parts is anyone's guess.

THE
MOST FUN
YOU CAN
HAVE WITH
YOUR HANDS
WITHOUT
GOING
BLIND

games radar
MORE KICKS PER CLICK

# STORAGE MORE SPACE, FASTER DRIVES, ALL FOR LESS MONEY

Whither Z-NAND and Optane? This will be a key question in 2020 for solid-state storage. Z-NAND and Optane are respectively Samsung and Intel's next-gen persistent memory technologies, intended to improve upon conventional flash memory. Both are already available, but they're expensive, and arguably don't quite deliver on the lofty expectations created by marketing pitches.

Intel will release its second-gen Optane tech in 2020 and it looks like a zinger. Code-named Alder Stream when applied to SSDs, as opposed to memory DIMMs, where Optane is also implemented, Intel claims three times the IOPs performance for its second-gen Optane tech, and slightly lower latency. Arguably, it's IOPs performance and latency, rather than peak data throughput, that make the biggest difference to how fast PCs feel on a day-to-day basis. So, improvements in those areas are exciting.

Less clear is whether Optane pricing will come down enough to make it more viable for mainstream PC users. Large capacity models are still relatively expensive. Here's hoping 2020 is the year Optane gets affordable. As for Samsung's Z-NAND, the company is keeping quiet about plans for a new generation of its low-latency persistent memory tech. For now, it has yet to push Z-NAND into the consumer space, and shows no sign of doing so in 2020, more's the pity.

## EXPRESS DELIVERY

The other big story in 2020 will be more widespread adoption of the PCI Express 4.0 interface. The immediate snag facing this bandwidth upgrade, which doubles peak transfer speeds compared to PCIe 3.0 to 2GB/s, is platform support. Only AMD offers native PCIe 4.0 support with its desktop CPUs; Intel CPUs only support PCIe 3.0. In fact, last summer, Intel even published marketing material to "prove" PCIe 4.0 doesn't matter for gamers.

It's not a huge surprise, therefore, to learn Intel's next family of desktop CPUs, Comet Lake, will not support PCIe 4.0, particularly when you consider that Comet Lake is yet another 14nm respin of its existing architecture that dates back to Skylake in 2015, rather than being based on the new 10nm node and the Ice Lake design.

At the very earliest, you're looking at late 2020 and Intel's first 10nm desktop processors, code-named Tiger Lake, for Intel to bring PCIe 4.0 support to consumers. Of course, PCIe 4.0 only improves raw bandwidth. While the prospect of up to 8GB/s of throughput is exciting, it does nothing for IOPs and random access performance. Moreover, the underlying performance of the TLC and QLC NAND chips in a typically affordable SSD can't get near the performance of a quad-lane PCIe 3.0 interface, let alone PCIe 4.0. So, the whole notion is rather academic except for the most expensive drives based on ultra-quick memory chips. All of that is perhaps why SSDs with PCIe 4.0 support have been slow to come to market, and

AMD's Ryzen CPUs will retain exclusive support for PCIe 4.0 SSDs for much if not all of 2020.

have all been based on the same Phison controller chipset. Intel, very likely, isn't going to ship consumer SSDs with PCIe 4.0, for instance, until it has a desktop platform that supports them. The other big players have limited motivation, too, given how few PCs with PCIe 4.0 support exist. Samsung has yet to announce PCIe 4.0 SSDs aimed at consumers, for instance, restricting its offerings to the enterprise market for now. Long story short, if you want to make the most of any PCIe 4.0 SSD in 2020, you're going to need an AMD platform in your PC. And your choice of SSD models will probably remain fairly limited.

## DENSITY DIRECTION

Still, there's more to storage than speed. What about data density? 2019 saw QLC or quad-level NAND flash memory push SSD prices down. In 2020, PLC or penta-level NAND flash that can store five bits of data in each memory cell might hit the market. Both Intel and Toshiba have detailed plans for PLC memory.

If PLC for 2020 is an unknown, what's certain is TLC and QLC memory based on stacked or 3D technology with higher layer counts and thus improved storage density. Intel, for instance, is aiming for 144-layer QLC flash memory in 2020. Samsung is already producing NAND flash with 100 layers. To put that into context, Samsung's 860 QVO drive uses 64-layer QLC NAND memory, as does Intel's 660P. A 1TB 860 QVO can be had for just over $100 today. More than doubling the number of layers, in Intel's case at least, implies a cost per GB of less than half that of today's QLC drives. In other words, big SSDs are going to get a lot cheaper in 2020. We've been talking about it for a long time, but 2020 looks like it will truly be the year of mass solid-state storage. A 4TB SSD for $150 in 2020? It's certainly possible.

# SCREENS THE YEAR HIGH REFRESH GOES MAINSTREAM?

Will 2020 be the year OLED tech finally makes the leap from HDTVs to the PC? Save for one exception, very likely not. OLED technology is already becoming more available in laptops, and that trend will continue. But desktop PC monitors? Not so much.

In fact, we're not totally convinced that's ever going to happen on a significant scale. Instead, we suspect the desktop PC monitor market may skip OLED and jump straight to micro LED, whose superior stability lends itself far better to PC apps, which tend to have persistent interface elements, like the Windows taskbar.

Problem is, micro LED is still in the R&D and very early commercialisation phase. It's not coming to mainstream TVs in 2020, let alone monitors. What you can expect is improvement of LCD tech. Earlier in 2019, LG rolled out the first IPS monitor with a claimed 1ms response time. Faster response means the ability to combine the superior colors and viewing angles of IPS with the speed that used to be the preserve of TN panels. Expect 1ms IPS monitors to become more widespread in 2020.

## REFRESHING NEWS

Of course, faster response is key to another aspect of monitor performance, namely refresh rates. PC monitors currently peak at 240Hz, while Asus recently announced a laptop with a 300Hz display along with a 360Hz desktop monitor. However, we're not expecting the latter to become the norm in 2020. That's because the returns diminish as the refresh rate rises. There's already some debate over the real-world benefits of 240Hz versus 144Hz for most PC users. Whatever your take, the benefits of going beyond 240Hz are very slim indeed.

That said, what you can expect in 2020 is 120Hz-plus monitors becoming more affordable, and for high refresh to transition into a mainstream and professional feature, not just for gamers. Already, Acer is selling pro-grade monitors with 144Hz refresh, demonstrating that it, at least, views high refresh as something non-gamers will appreciate.

HDR support will continue to improve and become more commonplace, too. In 2019, one of the big LCD panel makers, AU Optronics, announced a 32-inch 4K mini LED panel. The key advantage of mini LED is the number of local dimming zones it enables. The AU 32-inch panel offers 1,152 zones. That compares to the 300–500 zones typically seen in existing monitors with local dimming. That AU Optronics panel has just found its way into the new Asus ProArt PA32UCX.

Meanwhile, LG, arguably the world's leading maker of quality IPS panels for PC monitors, is planning a new panel with over 2,000 zones for late 2020, at which point the halo effect suffered by existing local-dimming monitors running in HDR mode should be well and truly sorted. While mini LED isn't exactly going to become the norm in 2020, we do hope to see more monitors with mini LED backlights, and thus more precise local dimming.

AU Optronics is also working on new VA panels with 240Hz in 30 and 32-inch sizes, adding another option for those who enjoy the improved contrast and saturation of VA tech. These VA panels might well become favorites for gamers.

## SLIM CHANCE

Monitors that combine all of the above – higher refresh rates plus mini LED tech – will also appear in 2020. AU Optronics has a 32-inch 4K panel with 144Hz and local dimming in the works that should finally appear in 2020. Another trend for 2020 will be even slimmer bezels. LG is developing a new technology known as Oxide that delivers "real borderless" panels.

Elsewhere, we're hoping that USB Type-C docking support will come down in price and become more widely available in 2020. Once you've connected a laptop to a monitor with a single cable for driving the display, charging, and connecting peripherals, you do not want to go back to an old-school multi-cable solution.

However, what we're sadly not expecting in 2020 is much progress when it comes to resolutions and pixel density. Apple's Pro Display HDR uses a 32-inch 6K panel manufactured by LG. Currently, it's unclear if Apple has exclusive access to that panel. Even if it does appear in other monitors, it will be a very expensive option. Meanwhile, 8K TV tech is still years away in terms of mainstream adoption, so the prospect of cheap 8K monitors adapted from TV sets isn't going to happen in 2020. In short, affordable monitors beyond 4K are unlikely to be a reality in 2020, which is a pity. ■

A glimpse of the future: The Asus ProArt PA32UCX packs 1,152 local dimming zones.

Getting started

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iCloud problems

Other problems

Professional repair options

# BE AN APPLE GENIUS

Save yourself a trip to the Genius Bar, as Adam Banks helps you do your own diagnosis and sort your Mac out!

The great thing about Apple products is that they just work, right? Well, most of the time, yes, that's right (thankfully). But what happens if your Mac simply doesn't want to play ball?

Is your Mac refusing to start up? Has the display gone all stripey? Or is it switching on okay but being really slow to respond? Your first thought may be to go online (on another device, of course) and book an appointment with an Apple Genius. Or arrange for an Apple Support call. Obviously, these guys are the experts – and it's fantastic that us Apple fans have these reassuring services to hand. But you could spend a while on the phone explaining the issue or you may not be able to book a Genius Bar appointment at a convenient time.

Well, once you you've recovered from that initial 'why isn't my Mac working?!' panic, you might be surprised to discover that some fixes are a whole lot easier than you'd first think.

We've collated a comprehensive bundle of the most common Mac problems that can occur and – more importantly – how to fix them! You don't have to be a technical whizzkid or a network know-it-all. Just follow our simple steps, and you and your Mac can carry on 'just working' in no time.

# Getting started

## When your Mac won't even power up

### WHERE IS THE POWER BUTTON, ANYWAY?

A desktop Mac will have a physical power button, usually on the back, marked with the 'standby' symbol, a circle broken by a line. MacBooks have a button at the top right of the keyboard; this includes Touch ID models, but to start from cold you'll need to press the button down, not just touch it.

### WHY DOESN'T THE POWER BUTTON RESPOND?

A common reason for not being able to power up your Mac is that it's already powered up but failing to wake from sleep. It's similar to when macOS hangs while you're working, usually because an app or Finder has crashed – it's just less obvious because you can't see what's happening. Hold down the power button until the power cuts out, which may be felt as a faint clunk. Wait a few seconds, then press it and let go to start back up.

### DOES THE MAC HAVE POWER COMING IN?

So pressing a key, the mouse or trackpad button doesn't wake your Mac, and pressing the power button doesn't bring the screen to life. Do you hear a chime or whir, or see any lights, or a faint glow on the screen? If not, that could mean there's no power. If it's a MacBook, make sure it's plugged in; try a different charging cable, and if possible another charger. For a mains-powered Mac, try a different cable. Check the mains power socket too.

### COULD IT BE THE BATTERY CAUSING THE PROBLEM?

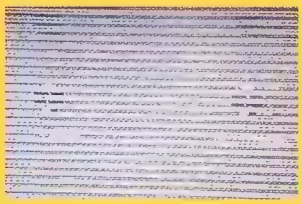
Yes: as MacBooks get older, the batteries hold less charge and eventually start to fail, with various symptoms. Specific problems with the 15in MacBook Pro (Retina, Mid 2015) and 13in MacBook Pro (non Touch Bar, from October 2016) may require urgent repair, which Apple will do free of charge: see **support.apple.com/en-au/exchange_repair**. Don't wait before addressing battery issues, because lithium-ion cells are prone to catching fire if faulty.

### IS IT JUST THE DISPLAY THAT'S NOT WORKING?

What if the Mac shows sign of life but the screen stays dark? If it's a separate monitor, unplug, reconnect and swap its cables. Check built-in menu options, such as input selection. If you haven't used it before, look online for info on compatibility; even if the manufacturer recommends it, others might have discussed problems on forums. If it's a MacBook screen, and your model has no known display issues, reset the SMC.

### WHY DOES THE SCREEN APPEAR GARBLED?

This can happen with a 15in MacBook Pro made between 2011 and 2013 due to GPU failure resulting in a 'stripey' screen. Apple no longer offers free repairs for these units, and working around the issue is complicated (see **bit.ly/mfrmmmbp2011gpu**).

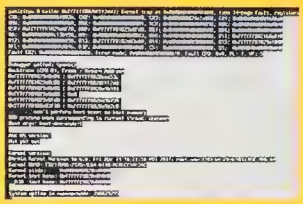


### THE MAC STARTED UP – WHY IS THE SCREEN STAYING GREY?

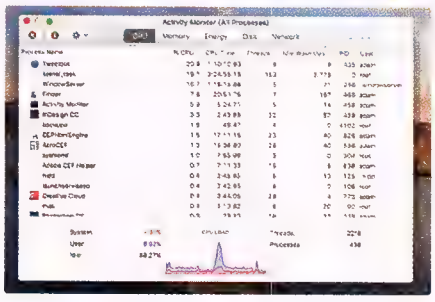
This can happen when macOS detects problems and tries to clean things up, so be patient and it might eventually start normally. If not, try starting up in safe mode. No? Reset the SMC. Still no? One possible cause is a faulty memory module, so if you've added any to your Mac, turn it off, remove the extra modules and try again. If it works, try again with the RAM, but you may need to replace it.

### NOTHING APPEARS EXCEPT WEIRD TEXT – WHAT'S HAPPENED?

A grey screen overlaid with blocks of scary-looking text means your Mac has suffered a kernel panic. It may be fine after you turn it off and on again. If not, restart in safe mode and update macOS. If it won't start at all, unplug all peripherals and try, then add back one at a time.

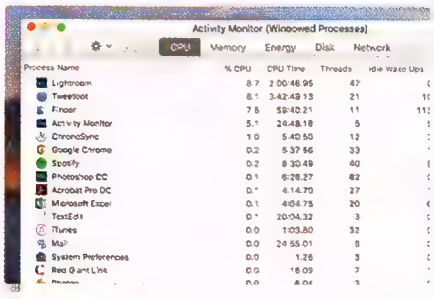


# Check Activity Monitor



## 1 OPEN ACTIVITY MONITOR

Activity Monitor is provided as part of macOS and lives in the Utilities folder inside Applications. To open it quickly, just press command-Space bar to launch Spotlight, type 'activity' and, when it comes up, press return.



## 2 LOOK AROUND THE SYSTEM

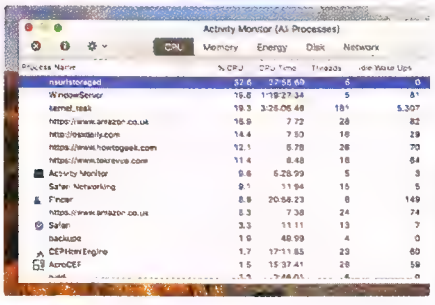
On the left, you'll see all the processes running on your Mac. You'll recognise some of these as apps, with their icons. Others will be more obscure. Pick Windowed Processes from the View menu to see only apps.

## AN APP IS BEHAVING WEIRDLY. WHAT SHOULD I DO TO FIX IT?

Close the app using File > Quit, command-Q, or if necessary force-quit (see below). Open it again. If it's still not OK, check its menus, the App Store or its website for updates to install. Install any updates to macOS (in Catalina's System Preferences, or in App Store > Updates). Restart your Mac and open the app. Still not OK? In the Finder, go to ~/Library/Preferences and drag anything named after that app to the Trash. If it works, you may lose some settings.

## 3 BROWSE FOR INFO

Click the Process Name column header to put everything in alphabetical order, or another heading to sort by what resources each process is using. Click the Disk tab at the top to see what's accessing storage.



## 4 SPOT THE SLOWCOACH

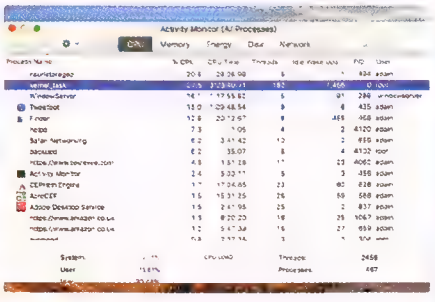
Click the CPU tab and rank by '% CPU' to see what's taking up a lot of processor time, potentially slowing down your Mac. If you see 'nsurlstoraged', that's Safari, so close any pages you don't need and see the % drop.

## HOW DO I MAKE AN APP CLOSE WHEN IT REFUSES TO

To avoid clogging memory, quit an app when you stop using it (File > Quit or command-Q). If the app has 'hung' and ignores you, hold option, click and hold the app's icon in the Dock, and choose Force Quit. Or choose Force Quit from the Apple menu (option-command-esc and pick an app. Unsaved work may be lost.

## 5 SCAN FOR OUTLIERS

Spotlight updates its index using processes named 'md' (for 'metadata'). Consider adding drives to System Prefs > Time Machine > Options to exclude them. If other processes are prominent, look them up online.



## 6 MAY CONTAIN NUTS

It's normal for 'kernel_task' to use some CPU, but if it's hyperactive, it may be trying to stop the CPU overheating. If that's not because you're doing something fancy in an app, try resetting the SMC.

# Files and backup

Get your drives and documents sorted.

## I CREATED A FILE, BUT WHERE DID I PUT IT?

When you lose track of something, just press command-Space bar to launch Spotlight and type all or part of the sensible file name you gave it… or failing that, any text you think would be in the document. Scroll through the results and double-click the one you want, or press the down arrow key down to it and press return.

## WHAT IF I STILL CAN'T SEEM TO FIND THAT PESKY FILE?

In a Finder window, go to the drive the file should be on, or ideally the folder it should be in. In the search box (command-F), enter part of the file name or content. In the bar below, select the drive or folder (not This Mac). Too many results returned? Set the options below to filter by kind, date or other criteria.

## I'VE DELETED A FILE THAT I NEEDED – CAN I GET IT BACK?

Usually, yes – that's why we have the Trash (aka Bin). Click its icon at the right-hand end of the Dock to open it as a folder, control-click the file you want and select Put Back. If it's not there, try Time Machine. And if you're not using Time Machine, start! See **support.apple.com/en-au/HT201250** for more information.

## I'VE SAVED OVER A FILE. HOW DO I REVERT TO THE OLD VERSION?

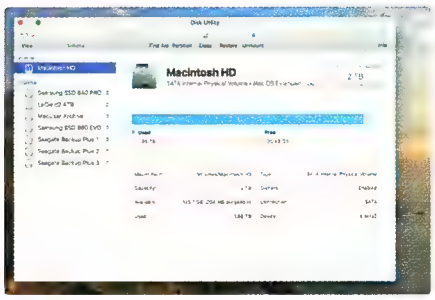
If you've just saved and still have the document open, try repeating Undo to get back to the state you want. Now Save this version, or use Save As to keep both – make sure you give this new version a distinct name to avoid overwriting the old one.

If you've closed the file, open it again and check the File menu for a Revert To command: if macOS' version control system is supported by the app, you'll be able to choose from previous saves. Other apps may have their own system, or may store temporary files that can be used to restore data: see online help or user forums for tips.

## WHY CAN'T I EMPTY THE TRASH? IT KEEPS GIVING ME AN ERROR.

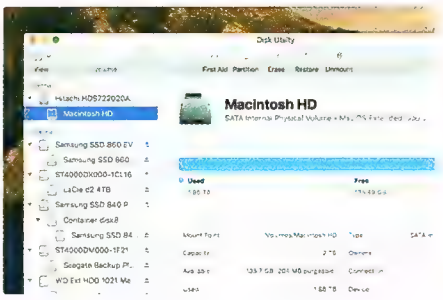
Emptying the Trash (control-click it for the option) erases any files in it forever, freeing drive space. But if a process has marked a file as in use, it won't be able to remove it. Get info on the file (command-I) and ensure Locked is unticked. Hold option while emptying, or press up arrow-option-command-left arrow. Failing that, you'll need to try a restart.

# Check a drive's health with Disk Utility




### 1 LAUNCH DISK UTILITY

Like Activity Monitor, the Disk Utility app can be found in Applications/Utilities, but it's easiest to open it via Spotlight (command-Space bar). It opens showing you all the drives inside or attached to your Mac on the left.

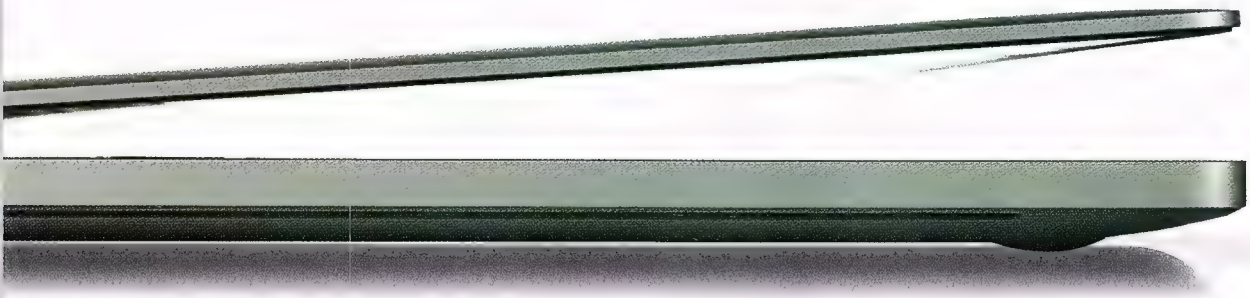



### 2 VOLUMES AND DEVICES

By default, Disk Utility shows 'volumes', partitions within drives that are visible to macOS. To see which drives they're on, choose Show All Devices from the View menu (or press command-2; command-1 shows volumes).

### 3 STARTUP DRIVE

You can select any drive or volume, but if it's the one where macOS lives, Erase, Restore and Unmount are greyed out. You can run First Aid to check the drive, but repairs may need Recovery mode.



## FILES THAT I NEED TO RETRIEVE AREN'T IN TIME MACHINE – WHY IS THAT?

In System Prefs > Time Machine, ensure Back Up Automatically is ticked. Click Options: drives or folders listed here won't be backed up (click the '–' sign to delist them). Tick 'Notify after old backups are deleted' to be warned when your backup drive gets full and old versions are removed.

## HOW DO I MAKE MORE SPACE FOR TIME MACHINE BACKUPS?

If you want to keep the oldest versions as well as new, you may eventually need more room. You'll need a single bigger drive (you can't add one on). Connect it, but don't attempt to switch to it in Time Machine's System Preferences: instead, read **bit.ly/apple-trtmbu**.

## WHERE'S MY LIBRARY?

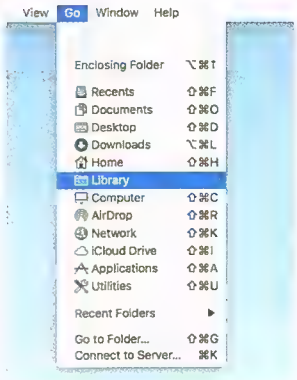
When a tip mentions the Library folder, often you don't want the one visible on your startup drive, but its hidden namesake in your Home folder (inside Users, with a house icon and your account name). Technically, its path is ~/Library. To reveal it in the Finder, hold Option and click the Go menu.

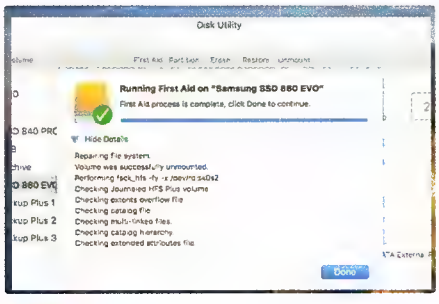
## AN APP CRASHED. AM I GOING TO LOSE MY WORK?

So many apps now have autosave or recovery, there's a good chance you won't, even if you haven't recently saved (command-S). If you notice something's amiss before the app stops working, use File > Save As (hold option if you don't to see this) to save a new copy, then quit; on re-opening the app, try the new copy, and if it's corrupted, try the previous save. If the app suddenly closes, reopen it and see if it recovers your document; if not, read its help to find out where a recovery file might exist.

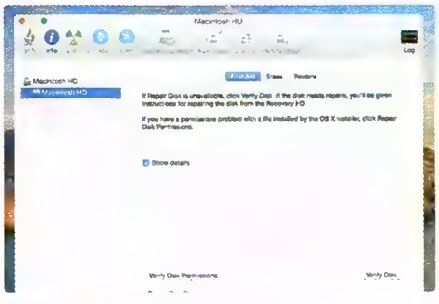
## WHY DON'T FILES OPEN IN THE APP I WANT?

When you double-click a document in Finder, it opens it in the app that macOS associates with its file type, such as .jpg or .rtf. These associations may get changed when you install apps. If you control-click a file and choose Get Info (select it and press command+I), you'll see its associated app in 'Open with'. You can change it for this file, or click Change All… to pick an app for all files of this kind. Or control-click a document and choose Open With…, or drag it from the Finder onto an app.

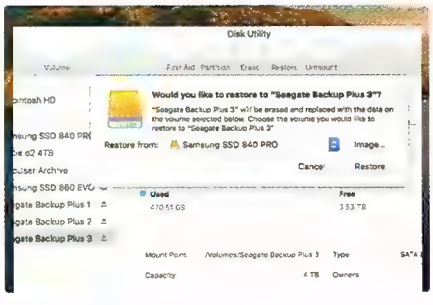




Disk Utility
Running First Aid on "Samsung SSD 860 EVO"
First Aid process is complete, click Done to continue.
Hide Details
Done

**4 FIRST AID**
When you run First Aid on any other drive, it'll automatically repair any minor issues it finds, having asked you to confirm the action before it starts. It'll also let you know if any problems are found that it can't fix.



**5 DISK PERMISSIONS**
Until OS X 10.10 Yosemite, Disk Utility had an option to verify permissions. These were often responsible for glitchy behaviour like settings being ignored or apps failing to run, but are no longer an issue now.




**6 RESTORE**
Select an empty drive and use Restore to duplicate the contents of a chosen drive. Try this for a drive that has unrepairable problems, then erase it; this may fix it. Again, for a startup volume, use Recovery.

# More serious problems

A variety of interventions may rescue a stuck Mac.

## WHAT DOES A FLASHING QUESTION MARK ON STARTUP MEAN?

Your Mac can't find a drive to boot macOS from. The first thing to do is wait, because occasionally a minor problem causes this to happen as a one-off. If the Mac eventually starts up, go to System Preferences › Startup Disk and select your startup drive. If not, try Recovery (see 'How do I use Recovery to get my Mac working again', below right).

## COULD RESETTING THE NVRAM OR SMC HELP TO SOLVE MY PROBLEM?

Inside every Mac made since 2006 are two components that manage system settings: NVRAM and the SMC. Non-volatile RAM (along with PRAM, parameter RAM) stores things like your startup disk selection, screen resolution, time zone and sound volume.

The system management controller (SMC) deals with battery and heat management, what happens when you press the power button or open or close a MacBook, the ambient light sensor (auto-brightness), keyboard backlighting and (on the few iMacs that support it) external video input.

Resetting NVRAM or the SMC shouldn't be necessary, but it's worth trying when nothing else fixes your problem. To reset NVRAM and PRAM, restart or turn on your Mac and immediately hold option-command-P-R (you might want a friend to help) until it finishes booting into macOS. It may restart itself again during the process (see **bit.ly/apple-nvrampram**).

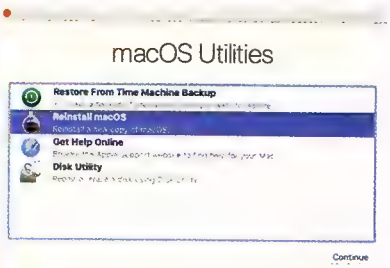
Resetting the SMC is slightly trickier, and the method depends on exactly which Mac model you have – specifically, how it's powered and whether it has the T2 security chip. See **bit.ly/apple-resetsmc** for the gory details of how to go about this. Don't worry, you won't need a screwdriver, but nimble fingers will certainly help.

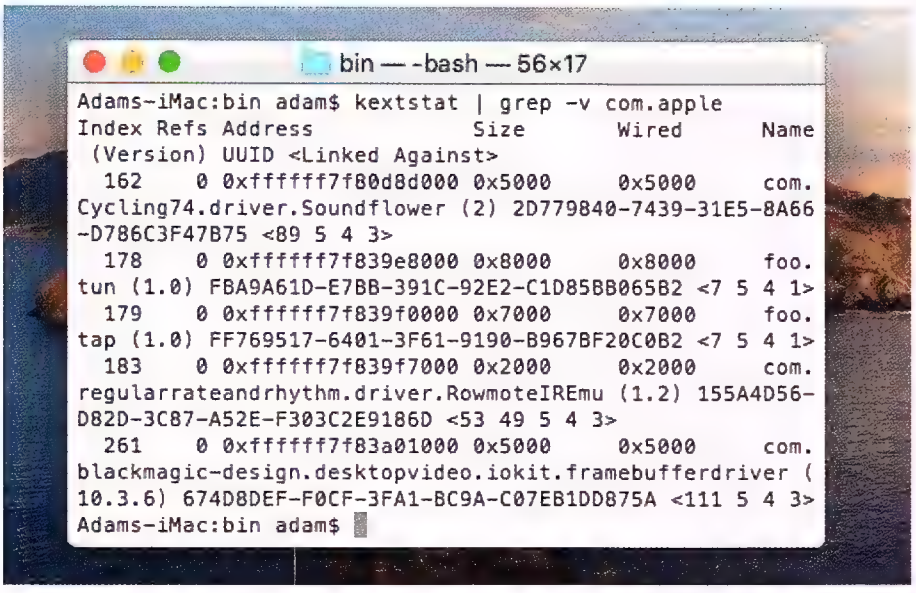
## HOW DO I USE RECOVERY TO GET MY MAC WORKING AGAIN?

Recovery is a stripped-down macOS that's kept hidden for emergencies. To enter Recovery, restart or power up your Mac and immediately hold down command-R until you see the Apple logo. If Recovery fails, you'll see a globe instead, meaning your Mac is trying to recover by downloading tools (you can force this by holding option-command-R while starting up). Either way, you get four options: Restore From Time Machine Backup (if you have one); Reinstall macOS; Get Help Online (browse Apple Support); and Disk Utility. Reinstalling macOS may fix things without deleting your data. Restoring from Time Machine is more drastic, but just as easy – it may take a number of hours, but should get you back to normal.

## CAN I CHECK WHICH DRIVE MY MAC IS STARTING UP FROM?

Your startup drive is chosen in System Preferences › Startup Disk. In most cases you'll only have one bootable drive. If you hold option while starting up, Startup Manager offers an explicit choice of drives, plus 'EFI Boot,' which lets you start up temporarily from your Time Machine backup.






## WHEN SHOULD I START IN SAFE MODE, AND WHAT DOES IT DO?

If your Mac won't start or persistently acts up, safe mode helps narrow down the cause. It loads only essential bit extensions (additions to macOS), disables extra fonts in case any are corrupt, deletes temporary files, and prevents any items auto-loading.

After starting up in safe mode, you can carry out a number of checks to identify the issue: see 'How to use safe mode to start up and find problems', below. Read more about safe mode at **bit.ly/safemodemac**. If a process of elimination suggests a kernel extension could be the culprit, check for third-party kexts: run Terminal (via command-Space bar) and type:

**kextstat | grep -v com.apple**

Wading through the code, most kexts show the name of their app (kexts called 'tun' or 'tap' will be for a VPN product). Google any that remain mysterious. Use the uninstaller provided with that app to remove it, along with its kexts.

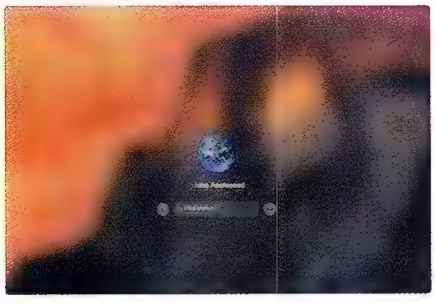
## IF I REINSTALL MACOS, WILL I LOSE ALL THE WORK ON MY MAC?

Normally, no. This Recovery option replaces macOS (the same version, or, with Internet Recovery, the one original to your Mac) without affecting your files. If you want to start afresh, or your startup drive has problems, use Disk Utility to erase it first (see **bit.ly/apple-remacosrec**).

## IS THERE ANYTHING ELSE I CAN DO WHILE IN RECOVERY?

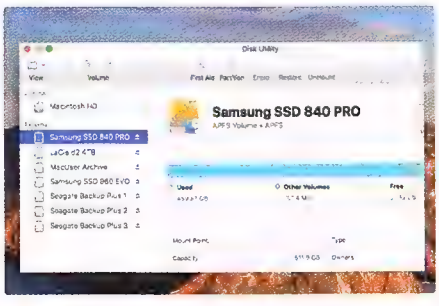
Unlike safe mode, Recovery doesn't get you into the Finder, but it does have a menu bar with three options. Firmware Password Utility lets you create a startup password for extra security, or disable it (see **bit.ly/apple-firmpass**). The Network Utility and Terminal apps work as normal.

# Use safe mode to start up and find problems



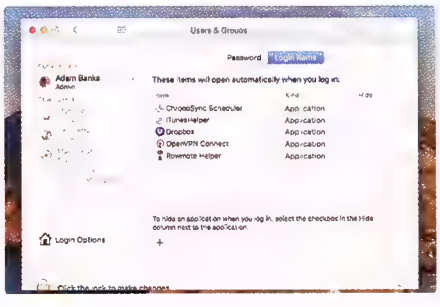
### 1 START UP IN SAFE MODE

To start your Mac in safe mode, restart or turn it on and immediately hold up arrow until the Apple logo appears, then a login window (try a wired keyboard if necessary). Release the up arrow key and log in to the Finder.




### 2 CHECK AND RESTART

You can run Disk Utility from here, or check your kexts in Terminal (see above). Restart normally. If you still get the problem, restart in safe mode and go to your user account in System Preferences > Users & Groups.

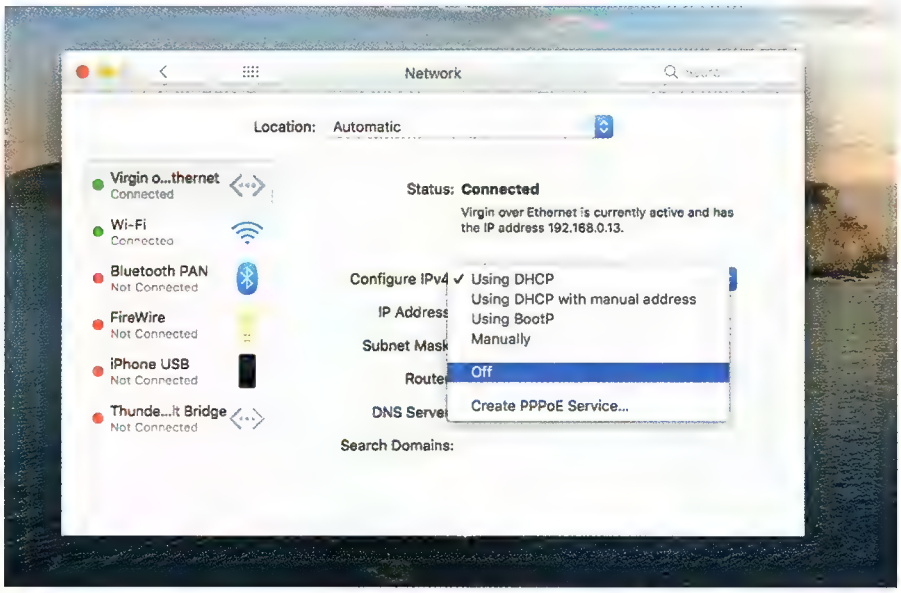



### 3 EXCLUDE LOGIN ITEMS

On the Login Items tab, make a note of the items, then select each and click '–' to remove it. Restart. If it's fixed, you can add back login items one at a time by clicking '+' and selecting the associated app, after updating it.

# Networking issues

## When you can't get connected to the internet or your other devices.




### WHAT SHOULD I DO WHEN MY MAC WON'T CONNECT TO THE INTERNET?

If your Wi-Fi stops working, click the Wi-Fi symbol in the menu bar at the top right of the screen (if it's not there, go to Network in System Preferences, select Wi-Fi on the left and tick 'Show Wi-Fi status in menu bar'). Check that the correct network is selected and showing plenty of bars. Choose Turn Wi-Fi Off, wait a few seconds, then go back and Turn Wi-Fi On. It should connect automatically, but again, pick your network if necessary.

If it's a wired connection that's playing up, such as an Ethernet cable to your broadband router, go to System Preferences › Network and select the connection on the left. Switch 'Configure IPv4' from 'Using DHCP' to 'Off,' click Apply, then switch back on; or unplug and reconnect the cable.

Don't forget to check your router, which could be the cause of no connection or a connection but no internet. Its status lights should indicate any problem, which can nearly always be resolved by turning it off, waiting 30 seconds and turning it back on. If not, turn to the router's companion app or remind yourself how to access its web configuration interface from your Mac.

### I THINK I'M CONNECTED TO THE INTERNET, BUT NOTHING SEEMS TO WORK?

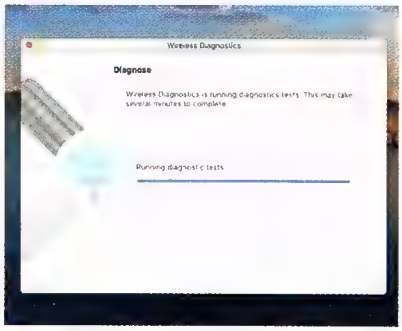
If you're on ethernet, go to System Preferences › Network and select your connection on the left. It should report that the connection is active and has an IP address. (For a Wi-Fi connection, access these details by clicking Advanced, then TCP/IP.) If not, turn the connection off and on, or reset your router – see 'What should I do when my Mac won't connect to the Internet?' above. If all seems well, check the system status page on your internet service provider's website to see if it has a fault.

### HAVE AN INTERNET CONNECTION – WHY WON'T WEBSITES LOAD?

This could be a domain name server (DNS) problem. In System Preferences > Network, select your connection and click Advanced, then DNS. Note down the two IP addresses shown (your ISP's DNS), remove each by pressing '-', and add 8.8.8.8 and 8.8.4.4 (Google's DNS) or 208.67.222.222 and 208.67.220.220 (OpenDNS).

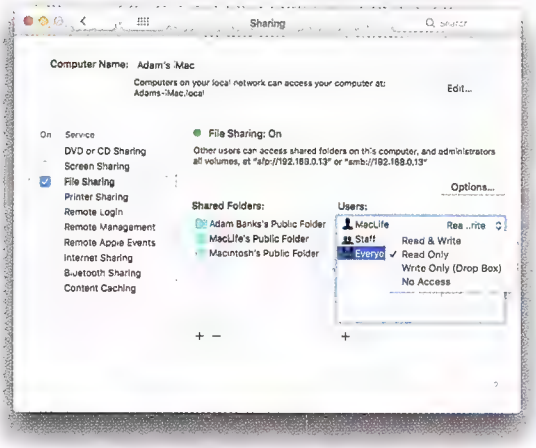
### WHY DOES MY WI-FI KEEP FAILING TO CONNECT?

Ask Wireless Diagnostics, an app tucked away in macOS that's best found with Spotlight – hit command+space bar. Run it, click Continue, ignore the requests for descriptions, click Continue again, wait and click Done. Double-click the file, open the folder and read the text files, especially those called 'diagnostics'.




### CAN I BACK UP MY MAC WITH TIME MACHINE OVER THE NETWORK?

Yes, you can back up to network-attached storage, as long as your NAS device explicitly supports Time Machine. You can even back up to a folder on another Mac. The destination drive will need to be in Mac OS Extended (Journaled) format. See **bit.ly/apple-budwtm** for details of these options.




## WHY CAN'T I ACCESS FILES SHARED FROM ANOTHER COMPUTER ON MY NETWORK?

To make files on your Mac visible across your local network (that is, to devices connected to the same router via Wi-Fi or Ethernet), go to the Sharing pane in System Preferences and tick File Sharing. Other Macs on your network should now find yours and show it under Shared in the sidebar of any Finder window.

By default, the only files they'll see are those in the Public folder for each of your macOS user accounts. Add other drives or folders and set their permissions on the right-hand side of the Sharing pane. Non-Mac computers can also access your shared folders via AFP or SMB using the IP address shown. If you can't see your Mac in the Finder on another Mac, press command-K (in the Finder) and either click Browse or enter the SMB address and click Connect.

## WHAT DOES THE MACOS FIREWALL DO, AND HOW SHOULD I USE IT?

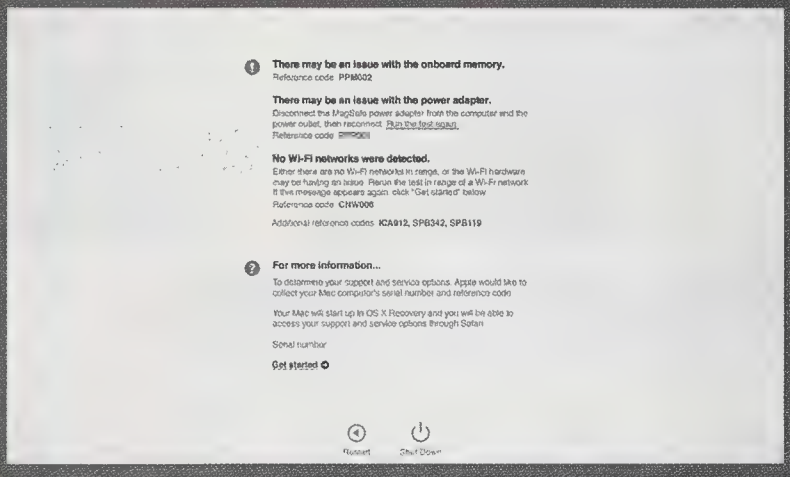
The application firewall in macOS is turned on by default and should stay that way. All it does is prevent unauthorised apps from accepting incoming network connections, a good way to defeat malware that shouldn't cause any trouble.

If an app can't access a connection that it needs to, go to System Preferences › Security & Privacy › Firewall, unlock the settings and click Firewall Options to check that it has permission to accept connections. Find out more about the application firewall at **bit.ly/apple-appfw**.

# More startup snags

## IS THERE A WAY TO CHECK MY MAC FOR HARDWARE PROBLEMS?

Hardware faults are relatively rare, but if you can't find the cause of a problem elsewhere, use the built-in Apple Diagnostics. First shut the Mac down (don't just put it to sleep) and disconnect everything except power, keyboard, mouse, display and internet. Turn it on and immediately hold the D key until you're asked to choose a language. Apple Diagnostics then takes a couple of minutes to do its work, and lets you know the verdict.


There may be an issue with the onboard memory.
Reference code: PPM002
There may be an issue with the power adapter.
Disconnect the MagSafe power adapter from the computer and the power outlet, then reconnect. Run the test again.
Reference code:
No Wi-Fi networks were detected.
Either there are no Wi-Fi networks in range, or the Wi-Fi hardware may be having an issue. Rerun the test in range of a Wi-Fi network. If the message appears again, click "Get started" below.
Reference code: CNW006
Additional reference codes: ICA912, SPB342, SPB119
For more information...
To determine your support and service options, Apple would like to collect your Mac computer's serial number and reference code.
Your Mac will start up in OS X Recovery and you will be able to access your support and service options through Safari.
Serial number
Get started
Restart
Shut Down

## HOW CAN I REPAIR ERRORS ON MY STARTUP DRIVE, SINCE DISK UTILITY CAN'T?

It can't carry out repairs on the drive you're running macOS from, so start up from Recovery and select Disk Utility. You can now look at your startup drive. If it can't be repaired, restore it to an empty drive, or restore from your Time Machine backup.

## I HAD TO REFORMAT MY MAC'S BUILT-IN DRIVE. NOW WHAT DO I DO?

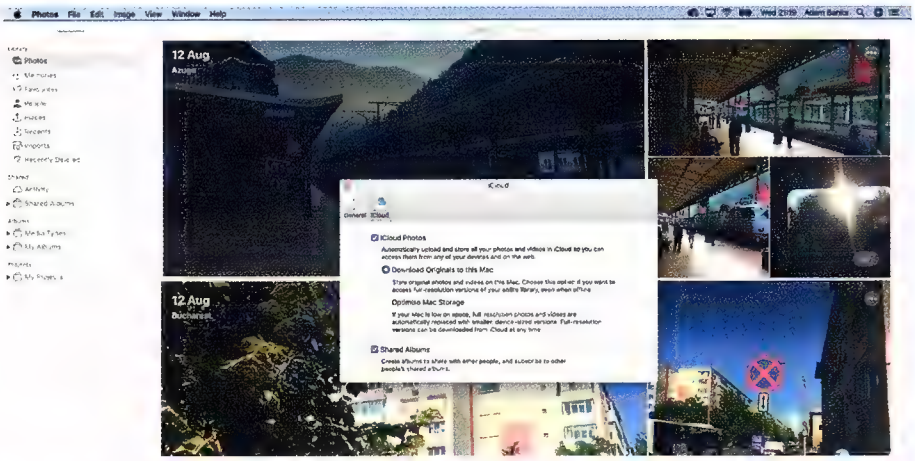
Start up from Recovery (or Internet Recovery). Then, if you have an up-to-date Time Machine backup, restore from that. If you have your work backed up somewhere else, opt to reinstall macOS, then you'll need to copy it all back over.

## WHY CAN'T I LOG IN TO MY MACOS USER ACCOUNT?

We've all been there: you enter the password for your regular user account into your Mac's welcome screen, and it wobbles in disapproval. What the heck? Take a minute to be sure of the password and type it carefully. Check for an up arrow, indicating that you need to take Caps Lock off. Still can't get in? Log in with a different user account, if there is one, then check your settings in System Preferences > Users & Groups. If you're really stuck, see **bit.ly/apple-pwmacosuser** to change or reset your password.

# iCloud problems

Check out these tips to ensure that your files are in sync and available.




## WHAT DOES ICLOUD PHOTOS DO, AND SHOULD I USE IT?

In iOS' Settings > Apple ID > iCloud > Photos and in macOS Catalina's Photos > Preferences, what used to be iCloud Photo Library is now just called iCloud Photos. If you activate iCloud Photos in iOS, all your photos are kept online until your iCloud storage fills up. To buy more, go to Settings > Apple ID > iCloud > Manage Storage > Change Storage Plan, or in macOS' System Preferences go to Apple ID (or iCloud) and click Manage.

On your Mac, tick iCloud Photos to upload all photos from your Mac in the same way (tick 'Copy items to the Photos library' in Photos > Preferences > General to include newly imported pics) and display all iCloud photos. If you select 'Download Originals to this Mac', all iCloud photos (from all your devices) are also kept on your hard drive, but note: as long as they're synced to iCloud, deleting one anywhere deletes it everywhere.

## CAN I SWITCH MY IOS DEVICE TO A DIFFERENT APPLE ID?

In Settings > Apple ID, scroll down to Sign Out, then sign in with the new account. If you try to switch again, you may have to wait 90 days to do so: see **bit.ly/apple-assocdevit**. Separately, in Settings > iTunes & App Store, you can freely switch the Apple ID used for purchases.

## CAN I TRANSFER SYNCED CONTENT TO A NEW APPLE ID?

Not as such, but when you turn off Contacts, Calendars or Reminders you can opt to keep their data on the device. When you log in with a new Apple ID and turn the service back on, you can opt to merge the data into that account. Family Sharing might also help: see **bit.ly/apple-sufs**.

## SHOULD I SYNC DESKTOP AND DOCUMENTS FOLDERS TO ICLOUD DRIVE?

This is set in System Preferences > Apple ID (or iCloud) > iCloud Drive > Options. It may be handy to give access to files in those locations when away from your Mac, and also serves as a backup. But this could quickly fill up your iCloud storage, so untick it if you don't need this.

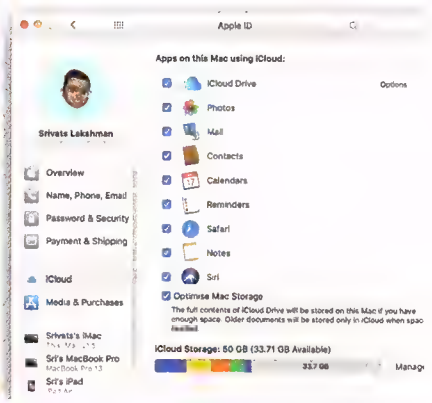
## HOW CAN I GET MY NON-APPLE EMAIL IN THE MAIL APP?

The Mail app can handle all types of email account, but turning on Mail in iCloud's settings (in System Preferences on the Mac or Settings on iOS) only activates your iCloud address. Add others (Gmail, your ISP email, etc) in Mail > Add Account in Mail on macOS or Settings > Passwords & Accounts > Add Account in iOS.

## WHY AREN'T MY FILES AND DATA SYNCING BETWEEN MY MACS AND DEVICES?

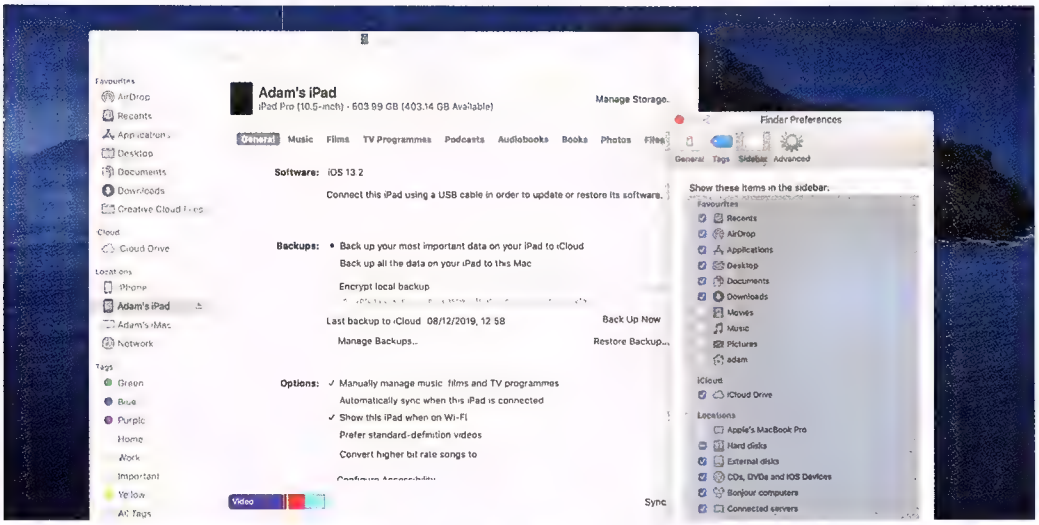
iCloud can magic all your photos, contacts, emails, contacts, calendar events and so on from each of your Macs and iOS devices to the others. If content fails to materialise on a device, most likely you haven't logged in to iCloud on it, or used the wrong account, or haven't turned on the service.

Check in System Preferences > Apple ID (or iCloud) on your Mac; in iOS' Settings, tap your name to check who you're logged in as, then iCloud to see what's set to sync. Also check **bit.ly/apple-sysstat** for any faults at Apple's end.



# Other problems

## Miscellaneous annoyances that might crop up.




### WHY CAN'T I ACCESS MY IPHONE IN THE FINDER WHEN I CONNECT IT VIA USB?

You're right in thinking that, in macOS 10.15 Catalina, desktop file exchange with iOS and iPadOS devices is now done in Finder. Connect your iPhone or iPad with a suitable USB cable and it should appear in the sidebar of a Finder window; select it to see options similar to those previously found in iTunes. To make this happen, you need to unlock your iPhone (with your passcode, Touch ID or Face ID), then select it in the sidebar, click the Trust button, and finally tap the Trust option on your device. You can tick 'Show this [device] when on Wi-Fi' to see it listed in the sidebar in future without a cable, whenever it's on the same network as your Mac. If the device still isn't visible in the sidebar after trusting it, go to Preferences on the Finder menu and, in the Sidebar tab, make sure 'CDs, DVDs and iOS Devices' is ticked.

### WHY WON'T MACOS LET ME RUN THE APP I NEED TO USE?

In System Preferences > Security & Privacy > General, you can allow only App Store apps or include those from all 'identified developers'. When you try to run an app downloaded from neither of the above, macOS' Gatekeeper will say it 'can't be opened'. If you're sure it's legit, control-click it and choose Open.

### MOJAVE SAID AN APP NEEDED UPDATING. NOW CATALINA WON'T RUN IT?

Apple announced years ago that it would end support for 32-bit apps; everything is 64-bit now. This means that macOS 10.15 Catalina can't run 32-bit apps. The only workaround is to install macOS 10.14 Mojave or earlier using Parallels Desktop or VMware Fusion and run your 32-bit apps within the virtual machine.

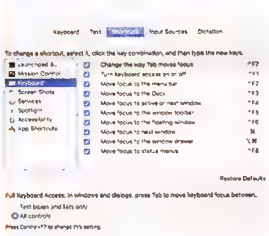
### WHY HAS MY MAC STOPPED TALKING TO MY BLUETOOTH ACCESSORY?

Control-click the accessory in System Preferences > Bluetooth, click the cross to remove it, then pair it again. If Bluetooth dies altogether, indicated by its menu bar icon turning into a grey zigzag line, try a restart; hold up arrow-option while clicking the icon to get a Debug menu with a reset option.

### HOW DO I OPERATE MY MAC WITHOUT A KEYBOARD AND/OR MOUSE?

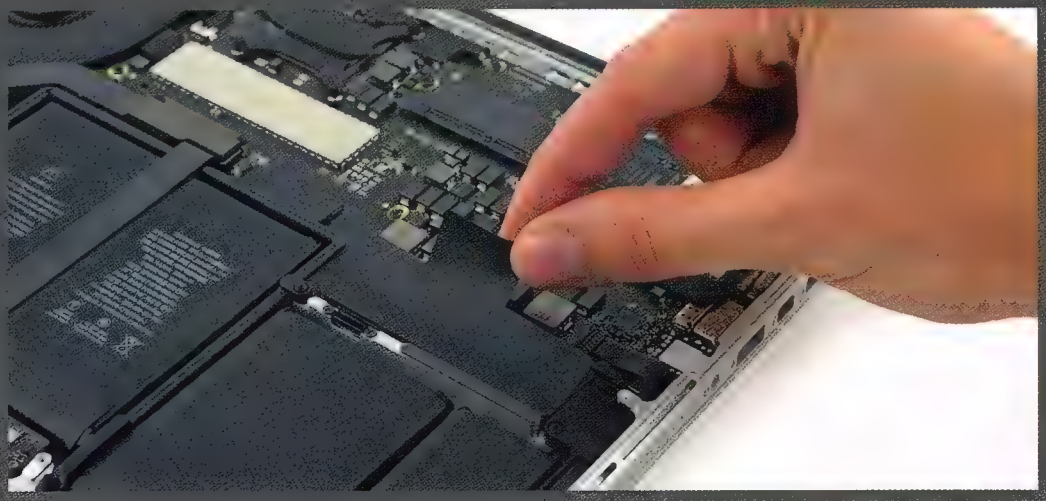
If your mouse or keyboard isn't working, you might struggle to use macOS to check why it isn't working. Activating Accessibility settings could make it easier, but that's also hard without an input device… The obvious answer is just to borrow one: any type of USB peripheral should work, and if you can't get both a mouse and a keyboard, you can manage with one of the two.

Most macOS features can be accessed with a mouse. If you only have a keyboard, use Spotlight (command-Space bar) to find and open apps and system features by name. Enter 'keyboard' for System Preferences' Keyboard pane, where in Shortcuts > Keyboard you'll find reminders of F-key shortcuts to navigate macOS. You may need to hold fn as well as the function key and modifiers shown (^ is control). Make sure Full Keyboard Access is set to All Controls (press control-F7). You can then move to wherever you need and Tab to the required option. Press Space bar to select it.



# Professional repair options

Sometimes there's no alternative to a bit of trained TLC.



## WHAT CAN I DO IF MY MACBOOK'S BATTERY IS GIVING UP THE GHOST?

It's obvious when your MacBook's battery starts to struggle: it runs down faster, then might charge erratically. These symptoms can have other causes, so try resetting the SMC. To check the battery, option-click the Apple menu and go to System Information > Power. Compare the cycle count to **bit.ly/apple-battcycnote**, which lists the design life for each model. If it's well under its limit, suspect something else is up; but if you've eliminated other problems and the battery is failing early, Apple will normally replace it free, in line with your consumer rights. If the battery is at the end of its natural life, it'll cost $189-$289 to swap it out: see **support.apple.com/en-au/mac/repair/service**. Other repair outlets might do it cheaper, or you can attempt the job yourself: try **iFixit.com** for instructions on how to set about it.

## APPLE HAS RECALLED SOME FAULTY PRODUCTS. IS MINE ONE OF THEM?

Before giving up on an old Mac or paying to get it repaired, check at **support.apple.com/exchange_repair** that it isn't among those with known issues. In fact, check the list now even if your Mac is running fine at the moment – these free repair offers don't last forever, so it's better to be aware and possibly get something done.

## HOW DO I GET HELP FROM APPLE WITH MY HARDWARE PROBLEM?

You don't need to be in warranty or have AppleCare+ to get free advice on issues with your Apple hardware. Start at **apple.com/au/retail/geniusbar**. You'll be invited to bring the product to a local Apple Store, but service via collection and delivery can be arranged if necessary.

## DISK UTILITY CAN'T REPAIR MY MAC HD. I HAVE A BACKUP, BUT WHAT NOW?

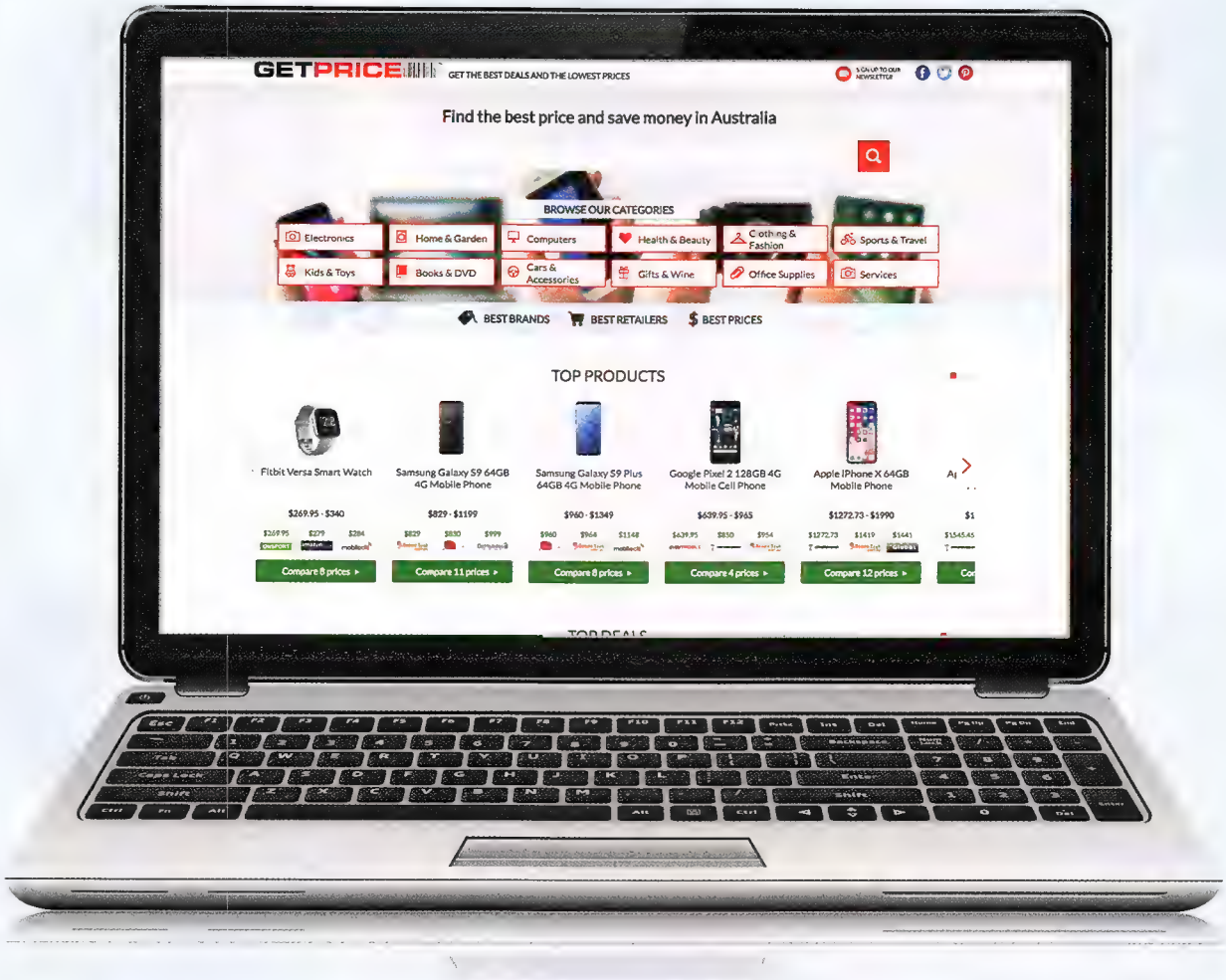
Replacing a Mac's internal hard disk or SSD is straightforward, but fiddly, so consider paying someone to do it. Make an Apple Store appointment to get a quote, but if your Mac is out of warranty, independent service providers will save you money. Take the chance to install a higher-capacity drive at this point.

## HOW MUCH WILL IT COST TO FIX MY SCREEN?

Most Apple screens can only be replaced, not repaired. If you paid for AppleCare+, Apple will replace your damaged iPhone or iPad screen for a small fee. Screen swaps can be done by third parties, often cheaper than by Apple. The cost of MacBook and iMac screens is more variable; start a service request with Apple at getsupport.apple.com, and compare local service providers.

## WHAT ARE MY CONSUMER RIGHTS WITH APPLE PRODUCTS?

If a product develops a fault due to a defect, you have a statutory right to a free repair or replacement, at least within the first two years and potentially for up to six. If you didn't buy from an Apple Store, this right is against the retailer. Apple takes its two-year warranty seriously. Apple Store staff often offer a free fix unless you've damaged the product; they may even help if bought elsewhere. And after two years, it's still worth asking.

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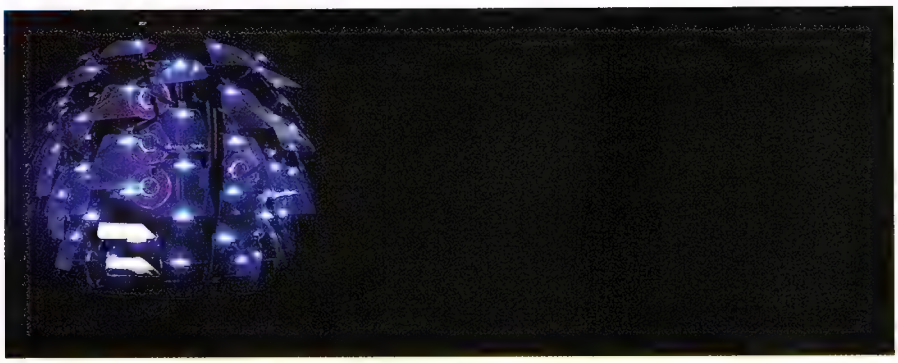


# System News

## CES always delivers hot new tech. Mark Williams drools over some of what was revealed this year.

With the Consumer Electronics Show (CES) over for another year it's always fascinating to see what new products and technologies companies are coming up with to sell to us. And despite the show being focused on mainstream consumer products, it's always good to see what new products get snuck in and shown off for the PC industry.

This year it didn't disappoint.

### SAMSUNG FINALLY DOES PCIE 4.0

The most exciting thing from Samsung's booth was a first look at its upcoming 980 Pro SSD. While Samsung is not the first to get on the PCIe 4.0 bandwagon, it's instantly the biggest player in the segment. To this point, all PCIe 4.0 SSDs have shipped with a controller from a company called Phison, which did a quick and simplistic job of tinkering with one of its older controllers to allow it to meet PCIe 4.0 specifications and unlock some quick and easy extra speed over the regular 3.0 compatible products.

This allowed it to achieve 5,000MB/s transfer speeds in sequential write scenarios, but quite average stats when it comes to IOPS, being the thing that really matters.

Samsung announcing the 980 Pro means it's finally finished its controller and from the tiny amount of information given by Samsung, it'll crush Phison-powered PCIe 4.0 SSDs (which to date is all of them), with Samsung quoting up to 6,500MB/s speeds.

Phison has had a good lead time with its rushed controller chip offering, but the SSD king is very likely about to claim its crown back.

### INTEL'S DISCRETE GRAPHICS APPEARS

Intel's commitment to bringing its own discrete GPU option to the market is well on track, with company representatives demonstrating the first Xe-powered GPU, dubbed DG1 inside of a thin and light laptop. Intel only showed it running Destiny 2, which isn't the most demanding title around, but it did at least show that it has working silicon and something to build up from.

With press being allowed hands-on with a discrete graphics card version of DG1 (which was just the laptop GPU slapped into a PCIe form factor and plugged into a PC), some smart media attendees did some high frame rate recordings of their *Doom* gameplay sessions and later reviewed the footage to discover that DG1 was only putting out about 40-50fps at 1080p low quality settings.

A bit of a let down really, given the expectations Intel is placing on it, but then this is just early test silicon and is intended mostly for getting developers working with the architecture and SDKs to start building up the ecosystem that'll be needed when Intel eventually launches its true AMD and Nvidia desktop GPU conpetitor.

### INWIN'S CRAZIEST CHASSIS YET

InWin has been making some of the craziest PC chassis out there lately, and at CES it somehow stepped up the game even further with the Diéy chassis.

Trying to describe this thing is almost an impossibility as it's unlike anything seen previously. This hanging case looks more like a beehive than anything, with "scales" (plexiglass platelets) that individually actuate to create the illusion of a living creature – each with an ARGB light embedded.

The scales can all lift up with a voice command to reveal the PC internals. And being a hanging chassis, InWin didn't waste the bottom of the case either, building in a projector to shine whatever image you desire onto the ground below.

### SHOP TALK

What products or technologies from CES this year excited you and why?

**John, TI Computers:**
*"We are most excited with the new displays, where vendors have pushed gaming displays totally beyond our imagination. Products such as the Asus ROG PG32UQX miniLED UHD gaming display. This enables up to a super bright 1400nit peak brightness with 10bit colour at 144Hz, and definitely sets a new standard for premium gaming. On the other hand, the refresh rate of esports gaming monitors has also been pushed 50% faster, to the unbelievably fast 360Hz refresh rate by the same company, something we would not dare to dream in the past. In fact, I was even told that IPS displays will begin to adopt technologies which were previously only achievable on the TN. Things like 1ms grey-to-grey response, 240Hz refresh rate, and clear tearing-free gaming experience are all coming this year. Together with the upcoming new GPUs from both Nvidia and AMD to drive them, I am very excited to offer them to our diehard gamer customers when they arrive."*

# Market Snapshot

## A sampling of PC systems available this month.

### Aftershock PC Flow

**$2,160 – TINYURL.COM/APC478AFT**

Wanting a high-powered gaming rig that doesn't break the bank? This may be the system for you.

The RTX 2070 Super within this build will handily let you play at 1440p resolutions easily, with all the effects turned up. It will even cater for 4K gaming too if care is taken.

Feeding the GPU is the Ryzen 5 3600, arguably the best value CPU on the market. It's not the fastest, or the best, but when it comes to gaming, it's 90% as good as any other AMD product.

The mesh high airflow case will keep temperatures nice and low, particularly with the third-party air cooler included. Great feature set for the price that punches above its weight in games.

**KEY SPECS: CPU:** AMD Ryzen 5 3600, **COOLER:** Deepcool Gammax GTE RGB, **MOTHERBOARD:** Asus TUF B450M-PLUS Gaming, **GRAPHICS:** Asus Dual GeForce RTX 2070 Super, **MEMORY:** 16GB DDR4 3200 MHz Memory, **STORAGE:** 512GB M.2 NVME SSD, 1TB 7200RPM HDD, **POWER SUPPLY:** 600W FSP/EVGA, **CASE:** Flow Stealth Micro Mesh.

### JW Computers GMR Aurora 2070 Super

**$2,399 – TINYURL.COM/APC478JWC**

Sporting more CPU threads than most of the other systems this month, this gaming rig affords users the extra computing grunt to do other tasks like rendering or live streaming more effectively, while asking not all that much more from your pocket.

The catch? The 3000MHz RAM is a bit of a letdown, adequate for sure, but it leaves CPU performance untapped by being rated lower than the ideal 3600MHz. Then there's the cooler, just AMD's OEM Wraith Prism, again adequate, but only if you're not interested in overclocking. The SSD size might be constraining with multiple large game titles installed.

A beefy system that shaves some corners here and there to get you some great performance for the money.

**KEY SPECS: CPU:** AMD Ryzen 7 3700X, **COOLER:** OEM, **MOTHERBOARD:** Asus B450 TUF, **GRAPHICS:** Gigabyte RTX2070 Super, **MEMORY:** Kingston Fury 16GB 3000MHz RGB, **STORAGE:** Kingston 250GB A2000 M.2 NVME SSD, WD Blue 2TB HDD, **POWER SUPPLY:** Thermaltake Smart 600W , **CASE:** Lian Li Lancool.

### Scorptec IEM RTX 2070 Super

**$2,549 – TINYURL.COM/APC478SCO**

Going up against the AMD systems this month is this Intel-based PC. It still demands a premium on price due to this CPU choice, but it's hidden well thanks to the rest of the system being quite well specced.

The water cooler is an interesting choice given the lack of overclocking ability on the CPU. Some money could've been saved going with air cooling instead.

Good storage and adequate RAM will allow this system to do what it does best, high refresh rate 1440p gaming. The high clock speeds of the CPU give this system the edge over the others in this aspect. The eight CPU cores and threads do hamstring it in other computing scenarios though.

A specialised, focused build for the discerning gamer.

**KEY SPECS: CPU:** Intel Core i7 9700F, **COOLER:** Corsair Hydro H60 (2018) CPU Cooler, **MOTHERBOARD:** Asus TUF Z390-PLUS WIFI, **GRAPHICS:** Asus Turbo GeForce RTX 2070 Super Evo 8GB, **MEMORY:** Corsair Vengeance LPX 16GB 3000MHz DDR4, **STORAGE:** Intel 660P 512GB M.2 SSD, Seagate BarraCuda 2TB HDD, **POWER SUPPLY:** SilverStone Strider 650W, **CASE:** Corsair Carbide 275R TG Black.

### TI Computers Infinity Ryzen 9 3900X

**$2,650 – TINYURL.COM/APC478TIC**

Coming in as the most expensive build this month, this also brings the most CPU cores and threads to the table at 12 and 24 respectively. This system is a processing powerhouse, some might even call it an entry level HEDT platform.

Not only will this system game well, but it'll render, transcode or run multiple VMs and much more quite handily.

The X570 motherboard – while nice to have – is a little wasted here as no PCIe 4.0 devices are used. Sure, the VRM's will be better suited, but a decently built B450 motherboard would do the same thing and save $100. The X570 at least gives some better future upgrade paths when devices are available. A great system for those that can utilise the extra CPU grunt outside of gaming.

**KEY SPECS: CPU:** AMD Ryzen 9 3900X, **COOLER:** Cooler Master Super Cooler, **MOTHERBOARD:** Asus Prime X570-P, **GRAPHICS:** Asus 8G DDR6 RTX 2070 Super, **MEMORY:** 16G DDR4 Kingston 3200MHz, **STORAGE:** 500G NVMe M.2 SSD, Seagate 2TB HDD, **POWER SUPPLY:** Corsair or EVGA 750W 80 Plus GOLD Power, **CASE:** Matrexx 55 RGB.

# My first PC

## Christian Guyton builds a simple, affordable computer, ideal for beginners setting out on their system-building journey.

If you're a seasoned PC builder, this might not be the build for you. We're just being honest; this is a straightforward build, the perfect PC for a novice tech head looking to build their first rig. We've made the instructions simpler than usual, and this system has as few cables and components as we could manage. Within reason, of course: We want this to remain a capable home PC, with a bit of gaming and workstation potential, at a sensible price point, so we're still including a GPU and a case with some RGB lighting.

The goal is to help you – or your PC-assembly-challenged pal – put together a functioning computer while also learning the basic building blocks of what makes a PC. Obviously, we have limited space to do this, but if you're ever uncertain of what goes where, don't be afraid to leaf through the manuals of each component. If you don't know your GPU from your PSU, you might want to take to Google for each step, to make sure you've got the right hardware.

While we have a list of specific ingredients for this build, don't feel compelled to stick to it. Some of the components here (notably the GPU and SSD) were chosen to keep the price down, so higher-spec components there wouldn't go amiss. We do advise against swapping out the CPU and motherboard for this build, though, to keep compatibility problems at bay.

This build should teach any rookie the fundamentals of PC building. If you're new to the ancient art of custom system building, or have a friend who's eager to build their first PC but doesn't know where to start, look no further.

## KEEPING IT CLEAN

We're a big fan of the case we're using: the Enso Mesh in white from BitFenix. It comes with a tempered glass window panel and some subtle but aesthetically pleasing RGB lighting on the front. The front I/O is a little plasticky, but for under 140 dollars, it's hard to argue.

The motherboard is an Asus ROG Strix X470-F Gaming, a standard motherboard with all the hardware we need for this easy build. Any brand of X470-based motherboard is fit for this purpose, should you find something at a better price. The X470 chipset is ideal for our CPU, a last-gen AMD Ryzen 5 2600. Yes, we could have chosen a superior third-gen Ryzen chip without making this build any more complicated, but the second-gen components are relatively cheap right now and have better overclocking potential for builders who want to experiment. The Ryzen 5 2600 comes with an AMD Wraith Stealth air cooler, too.

For RAM, we've got a two-piece kit of Corsair Vengeance LPX memory, which runs at 3,000MHz. Graphics are handled by another AMD piece, the Radeon RX 580, specifically Sapphire Tech's factory-overclocked 8GB Pulse model. The RX 500-series GPUs are great value at the time of writing, but the stock is swiftly drying up, and soon it might be better to opt for a newer RX 5500 or 5600 XT instead, provided you stick with the 8GB models.

All this is powered by a Corsair CX450 power supply, an excellent and affordable PSU that might not have modular cable design but doesn't have a heap of non-removable cables to clutter the build.

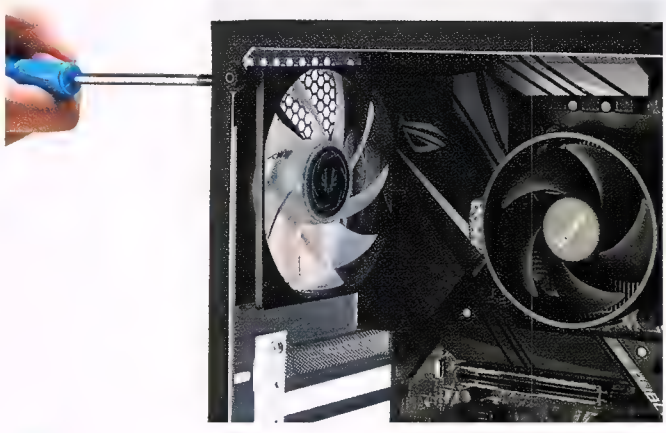
The final piece of this puzzle is a Crucial P1 1TB M.2 SSD – a little drive with a lot of storage space. There's room for additional drives in this build, but we're keeping it simple with an M.2 drive; no need for connecting cables and chunky hard drives here. And as always, we'll cap this build off with an install of Windows 10 Home.

### PARTS LIST

| PART | | STREET PRICE |
|---|---|---|
| CASE | BITFENIX ENSO MESH | $139 |
| MOTHER-BOARD | ASUS ROG STRIX X470-F GAMING | $321 |
| CPU | AMD RYZEN 5 2600 | $199 |
| CPU COOLER | AMD WRAITH STEALTH | N/A |
| MEMORY | 16GB (2X 8GB) CORSAIR VENGEANCE LPX @ 3,000MHZ | $124 |
| GPU | SAPPHIRE RADEON PULSE RX 580 8GB | $249 |
| PSU | 450W CORSAIR CX450 | $75 |
| SSD | CRUCIAL P1 1TB | $159 |
| OS | WINDOWS 10 HOME 64-BIT | $140 |
| TOTAL | | $1,406 |

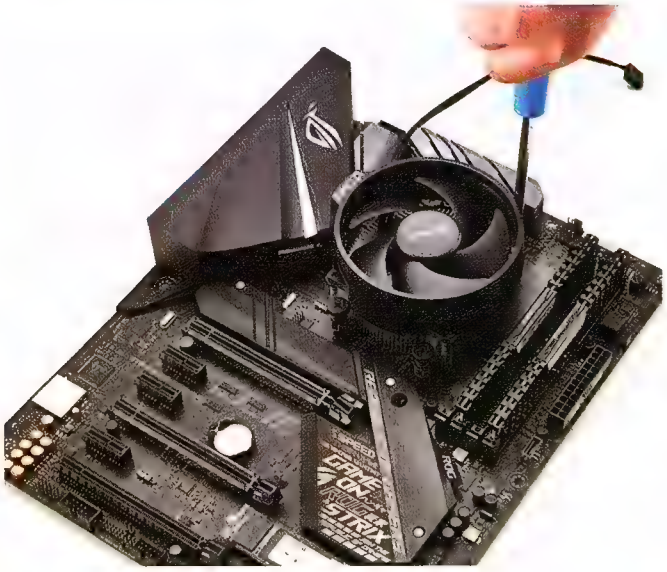
### 1 SANS FANS

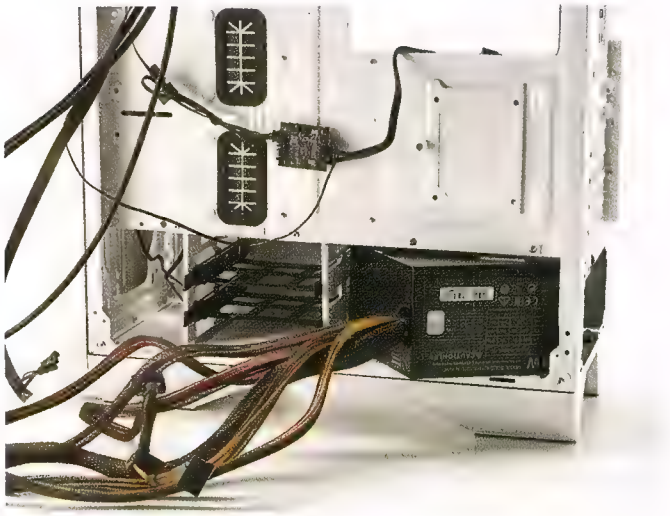
As is custom, we get cracking with a full case stripdown. Remove the window pane and metal side panel (the latter of which is secured with thumbscrews, although these may require a bit of persuasion from your screwdriver first), and then set them aside along with the magnetic dust filter on top of the case. Be sure to use a bowl or pot to keep all the screws you're working with in one place. Lastly, you need to remove two of the small blanking plates from the rear of the case, to make room for the graphics card's rear I/O – specifically, the second and third plates from the top of the case. That's all you need to do for now; shift the case out of your working space, and we'll move on to the motherboard assembly.



### 2 ANTISTATIC ACTION

Unless you have a dedicated workbench, unpack your motherboard and place it on top of the box it came in. The antistatic bag it arrives in only reduces static buildup on the inside; don't rest the board on top of the bag, or you're liable to get a little shock. With your motherboard unpacked, release the clips on one end of the memory slots, and push your two sticks of Corsair Vengeance LPX RAM into the slots marked A2 and B2, making sure that they click into place. Slot the Crucial P1 M.2 drive into the M.2 slot and screw it down to the tiny silver stand-off with a small Phillips head screwdriver. You also need to remove the rear RGB case fan, as it'll get in the way later on. Simply unscrew it from the back of the case and set it to one side, reinstalling it after the motherboard is mounted.



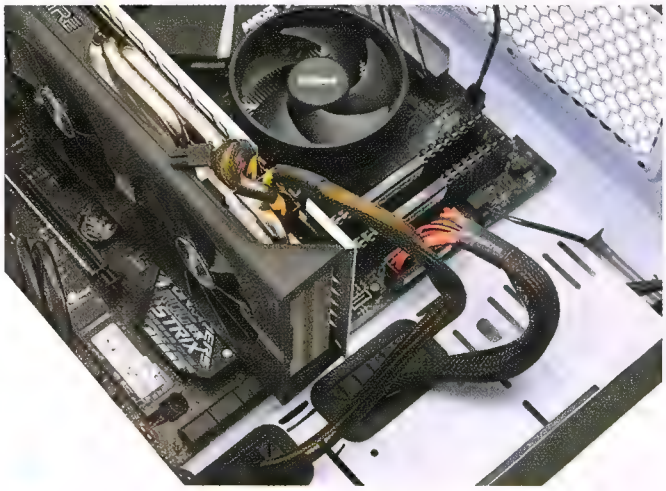


## 3 HEAT MANAGED

The CPU needs to be installed next. Lift up the metal retention arm, then drop the CPU into place in the socket, lining up the gold triangle in the corner with the triangle on the socket. If you bought your motherboard new, there is likely a pair of plastic brackets screwed down either side of the CPU socket. Unscrew these, but leave the metal cooler backplate attached, so that the screw stand-offs poke through the four holes around the CPU. Apply a pea-sized blob of thermal paste to the metal top of the processor, then take the CPU cooler and place it over the CPU, so the four spring-loaded screws line up with the cooler plate's stand-offs. Screw it down. Next, plug the cooler's power cable into the four-pin connector on the motherboard labeled "CPU_FAN."

## 4 POWER UP

The limited space for cable routing in this case means we're installing the PSU before the motherboard. Fit the PSU at the rear of the case and screw it down using its four black screws. You need four cables for this: the large ATX motherboard power cable, the eight-pin CPU power cable, the two-parter PCIe power cable for the GPU, and one accessory cable with a long thin L-shaped connector. The rest can be folded and tucked into the hard drive cage next to the PSU. Feed the mobo and GPU cables into the main case cavity, through the two rubber-sealed holes in the chassis, then the CPU power cable through the hole in the top-rear corner of the case. Untie the cables from the case's front I/O, and connect the RGB power connector to the accessory cable from the PSU.



## 5 MEXICAN STAND-OFF

You need to install three new silver stand-offs for the motherboard. These are included with the case; you need nine stand-offs in three rows. Now lower the motherboard into the case, making sure the rear I/O is lined up, then use nine of the black motherboard screws to secure it. Feed through the front I/O cables and plug them into the connectors on the motherboard, along with the ATX and CPU power cables (use the board's manual if you're unsure which cable goes where). Fit the GPU to one of the long PCIe slots, so that its rear I/O lines up with the two blanking plates we removed. Open the clasp on the PCIe slot before inserting the GPU's connector; it should lock into place, and can be secured to the rear of the case with two screws. Plug in that final power cable to the GPU.

## 6 CABLE CAPERS

The rear of this case has several locations to clip cables to, using cable ties to secure them. Try to route slack cables behind the motherboard in neat, flat lines, snipping off excess lengths of the cable ties with scissors (be careful not to cut any cables). You also need to plug in the two case fans, using the other four-pin connectors on the board, connecting the rear fan's RGB controller to the little PWM fan hub screwed on to the case behind the motherboard. Some of these cables can't be neatly routed, so just tuck any cable slack out of sight from the case window. If you don't have anywhere to secure a cable, you can bundle it and tie it off to itself to tidy things up. Once your case looks as neat as it can be, replace the side panel and window, and screw them on. Job done!

1 The rear case fan looks pretty good, with simple RGB lighting that syncs automatically with the lighting on the front of the case.

2 This RX 580 is a bulky card, so make sure that it's well screwed down to the rear of the case; the PCIe slot locks into place, but it doesn't support the weight of the GPU.

3 Our sole drive here is an M.2 SSD, the only kind of drive that is installed directly to the motherboard. SATA SSDs and HDDs must be installed elsewhere in the case, then connected to the motherboard via a SATA cable.

## Effective, But Not Too Complex

Performance-wise, this build didn't quite live up to our expectations. The Radeon RX 580 GPU is still functional, but AMD's 2020 update to its Adrenalin software actually makes the gaming performance slightly worse. The Crucial P1 M.2 drive also failed to meet expectations, although it's worth remembering that both components were fairly cheap – if you've got more cash, we advise replacing them with newer parts.

The Ryzen 5 2600 CPU worked well, assuaging any concerns we had about using a second-gen Ryzen instead of a newer Ryzen 3000-series chip. Yes, this build might not be as future-proofed as it could be, but there's no complicated BIOS meddling to be done. Using a third-gen processor would also have demanded use of an X570-chipset motherboard, which would have brought the price up further. The Wraith Stealth cooler included with the 2600 also did the job; while all-in-one liquid coolers are nice, AMD's stock coolers are effective, and ideal for beginners, thanks to their simple design.

We wouldn't change the RAM or power supply either; if you're able to find comparable models for cheaper, by all means save yourself some cash, but the components we used worked well and required minimal adjustment. The 3,000MHz memory did require use of the motherboard's automatic memory overclocking, but this was as simple as hopping into the BIOS's EZ mode and turning on the clearly marked D.O.C.P. profile for 3,000MHz functionality.

Was it an easy build? Yes. The BitFenix Enso Mesh could use a few more holes in the frame for cable routing, but if you take the time to pre-install your PSU and prep your cables, you shouldn't have any trouble. The case looks great for the price, too.

There were a few moments when we fell afoul of our own fat fingers. The case didn't really give us any grief, but plugging the CPU power cable and front I/O connectors into the motherboard was awkward. Use the motherboard manual to check you're putting everything in the right place, and with a bit of care, you shouldn't have too many problems.

This is a straightforward build, achievable by even the greenest tinkerer. We would encourage more experienced builders to make changes as they best see fit, but rookies are probably best following this guide to the letter, and only swapping out a few components if price permits. You can now build a capable but affordable first PC, and take our lessons with you to build a more advanced system in the future. ■

### BENCHMARK RESULTS

| | ZERO-POINT | THIS SYSTEM |
|---|---|---|
| CINEBENCH R15 MULTI (INDEX) | 959 | 1,257 (31%) |
| CRYSTALDISK QD32 SEQUENTIAL READ (MB/S) | 3,442 | 1,599 (-54%) |
| CRYSTALDISK QD32 SEQUENTIAL WRITE (MB/S) | 1,706 | 1,470 (-14%) |
| RISE OF THE TOMB RAIDER (FPS) | 95 | 76 (-20%) |
| TOTAL WAR: WARHAMMER II (FPS) | 55 | 42 (-24%) |
| TOM CLANCY'S GHOST RECON WILDLANDS (FPS) | 48 | 40 (-17%) |
| 3DMARK: FIRE STRIKE (INDEX) | 9,128 | 12,698 (39%) |

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Our zero-point consists of an AMD Ryzen 5 1600, 16GB Crucial Ballistix Sport LT @ 2,666MHz, an EVGA GeForce GTX 1060 3GB, and a 250GB Samsung 960 Evo M.2 PCIe SSD. All tests performed at 1080p at the highest graphical profile.

# PC blueprints

## The *APC* team's picks for a part-by-part perfect PC build to suit your budget.

### PARTS LIST

| PART | | PRICE |
|---|---|---|
| CASE | BITFENIX NOVA TG | $75 |
| PSU | CORSAIR CX450 80+ WHITE 450W | $75 |
| MOTHERBOARD | ASROCK B450M R4.0 AM4 | $99 |
| CPU | AMD RYZEN 5 2600 | $199 |
| GPU | EVGA GEFORCE GTX 1660 SUPER BLACK 6GB **NEW** | $419 |
| RAM | 8GB (2X 4GB) PATRIOT VIPER ELITE SERIES @ 2,666MHZ **NEW** | $59 |
| SSD | 120GB ADATA SU650 SATA III | $30 |
| HDD | 1TB WD BLUE 3.5-INCH HDD | $59 |
| OS | UBUNTU DESKTOP LINUX 18.04.3 LTS 64-BIT | $0 |
| APPROXIMATE PRICE: | | $1,015 |

In a post-sale world, keeping the prices low for this issue was difficult. There wasn't much to update in the budget build this time around, merely tweaking the setup in an effort to keep the price low, but maintain standards. To that end, we've swapped over to an EVGA GPU, more specifically the GTX 1660 Super Black. Really, though, any 1660 Super (or a 1660 Ti if you can grab one on sale) is a good choice for an affordable PC build. The only other thing we changed was the memory, sticking with Patriot, but changing over from Viper 4 to the Viper Elite Series to keep our costs down. Despite that, the overall price for this build has risen by a few dollars; most of the components here are the cheapest good-quality parts available, and the prices only vary so much. We're sorry, dear reader, but that's the best we can do.

### PARTS LIST

| PART | | PRICE |
|---|---|---|
| CASE | FRACTAL DESIGN MESHIFY C | $149 |
| PSU | 500W SILVERSTONE ET500 BRONZE | $59 |
| MOTHERBOARD | ASROCK X570 PHANTOM GAMING 4 | $248 |
| CPU | AMD RYZEN 5 3600X | $369 |
| COOLER | AMD WRAITH SPIRE | N/A |
| GPU | GIGABYTE RADEON RX 5700 8GB | $549 |
| RAM | 16GB (2X 8GB) PATRIOT VIPER 4 BLACKOUT @ 3,200MHZ **NEW** | $120 |
| SSD | 512GB SABRENT ROCKET M.2 PCIE SSD **NEW** | $129 |
| HDD | 1TB WD BLUE 3.5-INCH HDD | $59 |
| OS | WINDOWS 10 HOME 64-BIT OEM | $140 |
| APPROXIMATE PRICE: | | $1,852 |

Unlike the budget build, we've managed to drop the price of the mid-range build slightly. A few price drops here, some new components there, and we've ended up saving 42 dollars on last issue's build. First, we've taken some pointers from the budget build with the RAM; 16GB of Patriot's Viper 4 Blackout edition memory at 3,200MHz. Remember to hop into the BIOS to adjust the memory settings, making sure your memory is running at full speed. Lastly, we've added the 500GB Sabrent Rocket, which keeps PCIe Gen4 transfer speeds, but also comes with a chunky detachable heatsink.

UPGRADE OF THE MONTH

## 500GB Sabrent Rocket M.2 PCIe SSD

**$275, SABRENT.COM**

Sabrent's Rocket SSD is one of the more affordable Gen4 M.2 drives available on the market at the moment. Right at the moment it's a part you need to order from overseas, but it's readily available on **amazon.com.au**. We hope local distribution kicks in soon, though. The overall performance is as crazy-fast as we've come to expect from Gen4 SSDs, topping out at around 5,000MB/s in sequential write speeds. With 500GB capacity and a Phison memory controller, this drive is a steal right now.

**"Remember to hop into the BIOS to adjust the memory settings, making sure your memory is running at full speed."**

No, we're not putting a third-generation Threadripper in this PC. Yet. We'll get there, but right now the pricing is simply too steep to justify it; new TRX4 motherboards are also monstrously expensive, so upgrading this system to the third gen would throw a comfortable thousand dollars or more on the overall price. Second-gen Threadrippers, such as the 2950X, are great value right now, so we just don't think it's worth the asking price yet.

Even without making that upgrade jump, the price of this build has still risen by $148 this month. A distinct lack of sales (and our insistence on keeping a Gen4 M.2 SSD for future upgrade potential) means there were few opportunities to make savings.

We are sticking the G.Skill's Sniper X memory at 3,600MHz, ensuring we have great memory support for our Threadripper CPU. The last change we made was in service to M.2 Gen4; we want this build to be ready for a Threadripper 3960X, and that means ultra-fast SSD transfer speeds. To that end, we've replaced the Samsung 970 Evo SSD with Gigabyte's weighty Aorus SSD. The Aorus SSD was one of the first Gen4 M.2 drives on the market, and its performance still holds up (even if the heatsink is a pain to remove). ■

### PARTS LIST

| PART | | PRICE |
|---|---|---|
| CASE | NZXT H700I | $229 |
| PSU | 850W CORSAIR RM850 80+ GOLD | $189 |
| MOTHERBOARD | ASUS PRIME X399-A **NEW** | $279 |
| CPU | AMD THREADRIPPER 2950X | $1,179 |
| COOLER | COOLER MASTER MASTERLIQUID ML360 RGB 360MM AIO | $179 |
| GPU | MSI GEFORCE RTX 2080 SUPER VENTUS 8GB | $1,199 |
| RAM | 32GB (2X 16GB) G.SKILL SNIPER X SERIES @ 3,600MHZ | $269 |
| SSD | 1TB GIGABYTE AORUS GEN4 NVME M.2 SSD **NEW** | $388 |
| HDD | 2X 3TB SEAGATE BARRACUDA COMPUTE | $360 |
| OS | WINDOWS 10 HOME 64-BIT OEM | $140 |
| APPROXIMATE PRICE: | | $4,411 |

# how to

» QUICK TIPS

# Experts solve your computing problems

**The APC team tackle problems across the spectrum of devices and software we use. Learn a new trick or fix you can use.**

## HARDWARE

### LAPTOP FAN TOO LOUD

***Yesterday, I left my laptop running while on charge while I went for dinner. When I came back around 90 minutes later its fan was running extremely fast and loud, while the bottom of the laptop was very hot. I shut down my PC, and today it's working fine. Is it due to overcharging?***
**Fros Vonex**

The fan will run hard and the laptop feel hot whenever it's running under load – in other words, some intensive process in running in the background. Should the problem reappear, open Task Manager and use the Processes tab to review the CPU and Memory scores – if either is over 50% then click the column header to see which app or process is responsible for the problem. Closing this should reduce the load on your CPU, reducing its temperature and allowing the fans to slow down. If the problem is more persistent, check the vents for dust and other obstructions to ensure the fan is running freely. Also consider investing in a laptop cooler like the Targus Cooling Pad – this provides supplementary cooling, plus lifts the laptop up to improve air flow.
**Nick Odantzis**

## OUTLOOK

### CORRUPTED DATABASE

***I suspect my Outlook database has been corrupted. Emails addressed to one person appear – in the Sent folder – to have been sent to someone else. I've checked, and they're going to the correct people. Any pointers?***
**Dev Hope**

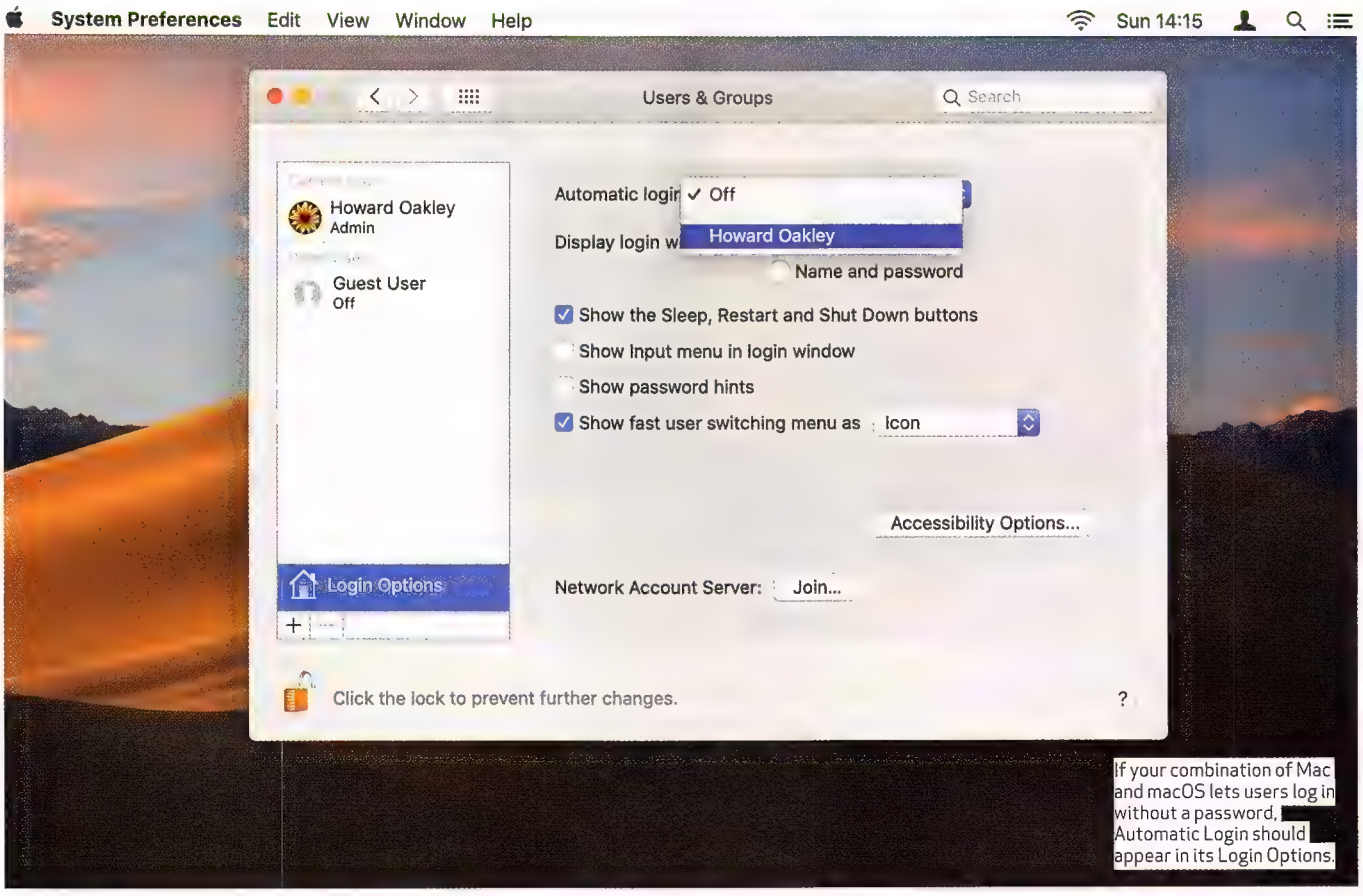
The Outlook Contacts folder isn't the only place you'll find email addresses – when you type people's names into the To field of an email, they're recorded in a separate autocomplete list that is designed to help speed up the entry of email addresses going forward. In the past, this information was stored in a file with a .n2k extension, which had to be deleted manually, but is now split across this and another hidden system file. Thankfully, in Outlook 2010 or later, you can clear this list and fix the problem by navigating to 'File > Options > Mail' and click the 'Empty Auto-Complete List' button to purge the list and correct the problem. Should you ever wish to simply view or edit this list, use N2KEdit (**www.nirsoft.net/utils/outlook_nk2_edit.html**) – despite the name, it's able to work with the auto-complete list from later Outlook versions too.
**Ian Sleightholm**

## SECURITY

### PASSWORD-FREE LOGIN

***We keep iMacs in a secure area which we want to give free access to without using a password. How can we do this in Mojave?***
**Jim Utterback**

Reduce the stress on your laptop fan with a cooling pad.




If your combination of Mac and macOS lets users log in without a password, Automatic Login should appear in its Login Options.

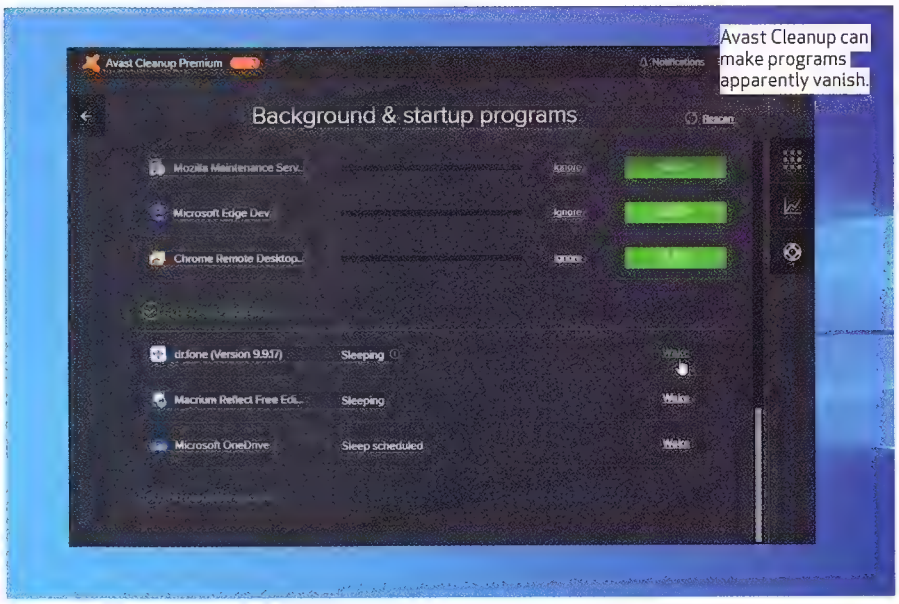
Normally, configuring a Mac to start up into a user account without using a password is a seriously bad idea. Apart from a complete lack of security, it also means that every user of that Mac would have access to the same account, none could do anything in privacy, and key features like iCloud wouldn't be possible. It's often simpler to set each Mac up with a simple password which users can type in from a note placed on that Mac.

However, if physical access to the Macs is strictly controlled and users are in full agreement, it should be possible, at least on a Mac without a T2 chip, like the 2019 iMac.

Ensure that the startup disk doesn't use FileVault encryption, and that the account to be used doesn't use iCloud to log in or for its keychain. Open the Users & Groups pane, and select Login Options for the user account. Click on the padlock and authenticate, then enable the Automatic login item in the pop-up at the top, ensuring that no password is set for that user.

You'll also need to open System Prefs › Security & Privacy, and in the General tab ensure that none of its upper checkboxes are ticked, as they would prompt for a password to wake that Mac up or clear its screen saver. If the firmware in these new iMacs still doesn't oblige, you'll have to revert to using a short and simple password instead.

**Howard Oakley**




Avast Cleanup can make programs apparently vanish.

## APPLICATIONS

### APPS DON'T LAUNCH

***I have recently had problems with certain apps not working correctly on my laptop. First, Adobe Reader stopped opening – it would appear to start, but then after the spinning icon appeared nothing happened. I tried uninstalling and reinstalling, but no luck. I've switched to Wondershare PDF Element, which does work without problems. Now Garmin Express refuses to open too, again after removing and reinstalling. I checked with Avast Cleanup Premium to see if there may be issues – it flagged up 43 broken shortcuts, which I allowed it to fix, but the problem persists.***

**Allan Burdis**

The blame almost certainly lies with Avast Cleanup Premium. I never recommend cleanup tools, because sooner or later they end up introducing problems precisely like those you've encountered. Their

LEAWO free Blu-ray player lets you access the disc's menus.

value is questionable – they rarely speed things up, and tools like Windows' own Storage Sense do a perfectly good job of keeping the clutter off your system.

In this case, we suspect the problem is linked to Avast Cleanup's 'Background & startup programs' component. Navigate here via the 'Speed up' icon, then scroll down and click the green '# programs sleeping' link to expand the section. If we're correct, you'll find both Adobe Reader and Garmin Express are listed here – clicking Wake next to each one should restore them to life.
**Nick Peers**

HARDWARE
## UNSTABLE UPGRADE

***I recently upgraded my graphics card to allow me to use a new 4K monitor, but now the PC keeps rebooting every few minutes after fitting it. If I revert to the old card, everything's fine. What's going on?***
**Paul French**

Paul confessed that he'd simply swapped out his old AMD card for a newer Nvidia card without first uninstalling the older card. On closer inspection, the crash revealed the error was being traced to the 'Catalyst Control Centre', which is the AMD graphics driver software. On uninstalling this from his PC, the problem ceased and he was able to enjoy the full resolution of his new display. It's important to uninstall your old hardware completely: uninstall it in Windows, then shut down your computer. Swap old the old component for new, then restart your PC – Windows should detect the new card and install the latest Microsoft-certified driver. Once done, you can then download the latest manufacturer driver if you wish to take full advantage of it.
**Alex Cox**

MEDIA
## FREE BLU-RAY PLAYER

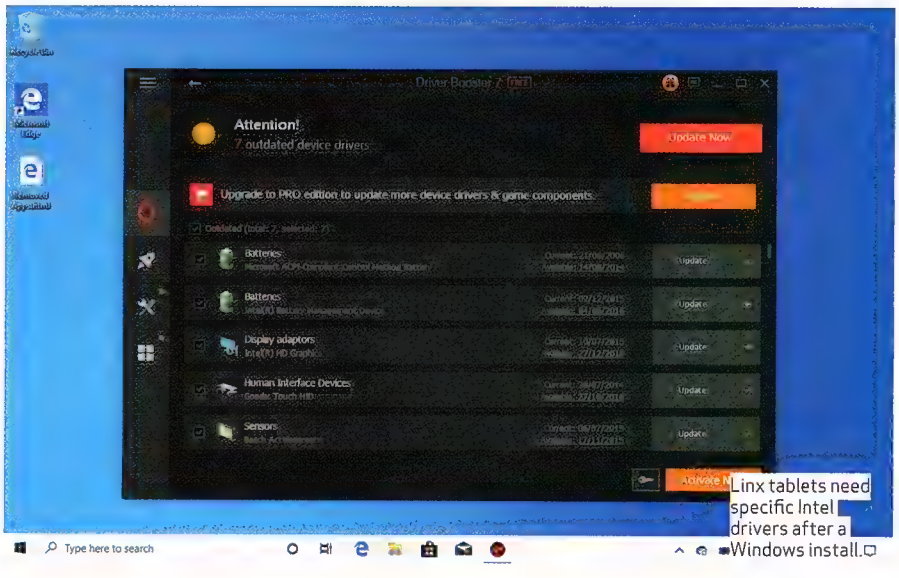
***I'm looking for a way – preferably free – that allows me to watch Blu-rays on my Windows 10 PC with all the menus. VLC Media Player does a decent enough job, but its lack of menus makes it difficult to navigate.***
**Gemma Soubry**

Try LEAWO Blu-ray Player (**www.leawo.org/blu-ray-player**), which despite the nag about being unregistered, is completely free to use for watching Blu-rays. You gain access to the menus, and it also promises region-free playback for both Blu-rays and DVDs. It can also be used to play a wide range of video and audio files too. The Premium version (US$23 per year) adds the ability to convert your Blu-rays and DVDs to MKV files, but this functionality can also be found elsewhere for free (try MakeMKV – **www.makemkv.com**).

TABLET
## MISSING KEY DRIVERS

***I have a Linx 1010 tablet and was only able to upgrade to the latest version (1909) of Windows by installing it from scratch. The install went fine, but now I find key functionality – the touchscreen, audio and so on – is missing. I've tried searching Windows Update, using DriverBooster, but no luck. Given it's an Intel chip, I'm hoping the drivers exist somewhere on the Intel website but have no idea what I should be looking for. Please help!***
**Dennis Laurence**

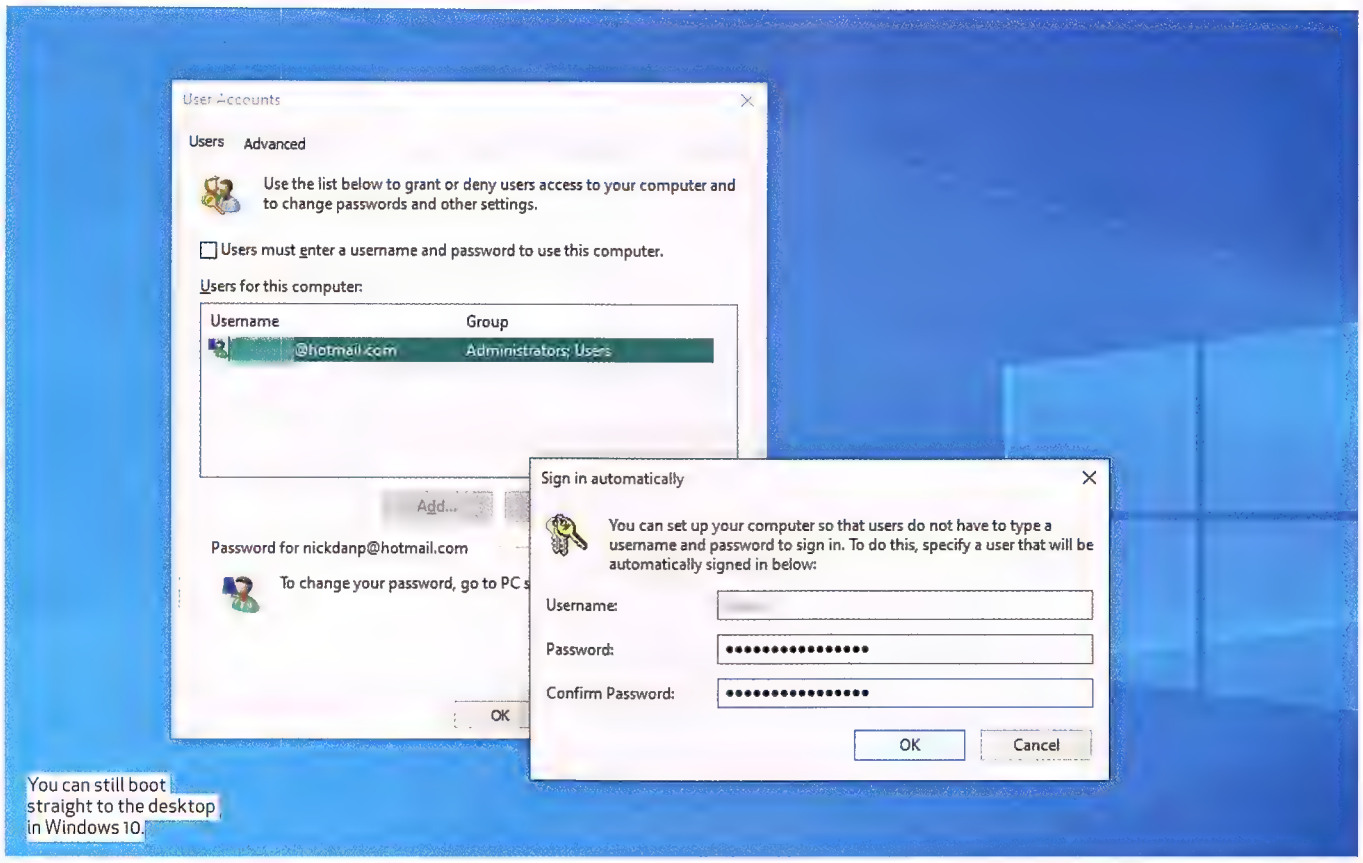
Linx no longer supports the 1010-series of tablets, but thankfully the user base has tracked down the key drivers you need to get this functionality back again. You need to download a single driver from Intel: the System-on-a-Chip (SOC) Driver Package for STCK1A32WFC, which you can download directly from **https://downloadcenter.intel.com/download/25311** – save the SOC_BYT_Win10_32.zip package (less than 1MB in size, believe it or not) to your PC, extract the contents and then run the setup file. Once complete, you'll find all the missing functionality is back in place – if you then run a scan with DriverBooster again, you'll find it will detect driver updates for all those core components, which you can download and install if you wish.
**Ian Sleightholm**



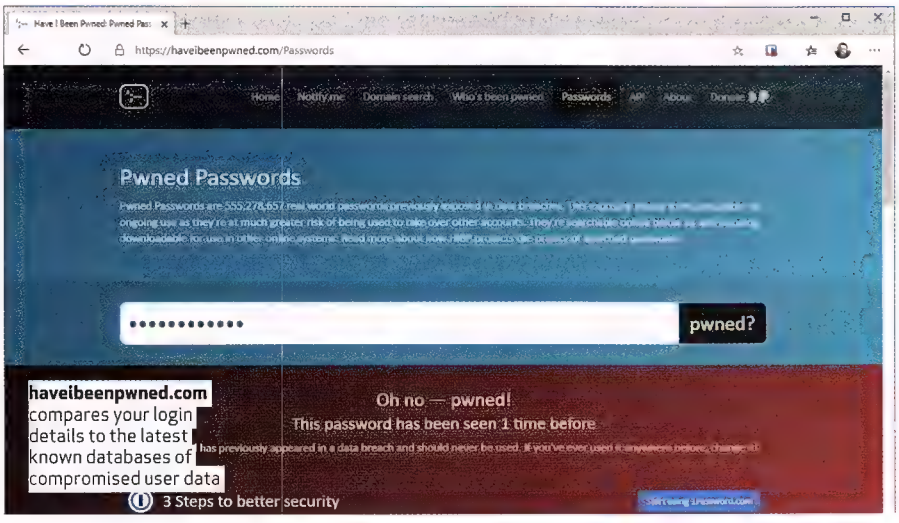
Linx tablets need specific Intel drivers after a Windows install.

WINDOWS
## LOGIN-FREE WINDOWS

***I recently reinstalled Windows using the excellent guide in your magazine, and it went very well. On setting up I was asked to create a PIN number, which I did, recalling that in previous setups I've been able to remove this later. However, this time, after removing the PIN I find I need a password to log into the machine. Is there any way I can circumvent this?***
**Martin Gulliver**


User Accounts
Users
Advanced
Use the list below to grant or deny users access to your computer and to change passwords and other settings.
Users must enter a username and password to use this computer.
Users for this computer:
Username
Group
@hotmail.com
Administrators; Users
Add...
Password for nickdanp@hotmail.com
To change your password, go to PC s
OK
Sign in automatically
You can set up your computer so that users do not have to type a username and password to sign in. To do this, specify a user that will be automatically signed in below:
Username:
Password:
Confirm Password:
OK
Cancel

You can still boot straight to the desktop in Windows 10.




haveibeenpwned.com compares your login details to the latest known databases of compromised user data

Press Win-R and type 'control userpasswords2' and press Enter. Verify your username is selected from the list (assuming it's not the only one there) and then untick the 'Users must enter a user name and password to use this computer'. Click Apply, enter your Windows password twice when prompted, and click OK.

Reboot and you'll no longer need to log into Windows.

Note, you'll still be prompted for it at certain points, such as when waking Windows from sleep (disable this by choosing Never under 'Require sign-in' via 'Settings › Accounts › Sign-in options')

**Alex Cox**

## SECURITY
## HAS MY PASSWORD BEEN COMPROMISED?

***I've switched to using random passwords in conjunction with the Bitwarden password manager. How can I tell if my master password is a safe one?***

**Julie Bracken**

This step-by-step guide reveals how to first enable two-factor authentication (2FA) on Bitwarden for additional protection against breaches, then shows where to go to find out if your password has been compromised.

Log into **https://vault.bitwarden.com** and navigate to 'Settings › Two-Step Login'. Click Manage next to 'Authenticator App' or 'Email' to configure a secondary challenge when logging into your accounts for greater protection.

To check if a password is compromised, go to **https://haveibeenpwned.com/passwords** – check the lock in the Address bar to verify it's not been hacked, then enter your password and click the "pwned?" button to check.

If your password has been compromised, you'll need to log back into the Bitwarden vault and this time navigate to 'Settings › Account'. Tick 'Also rotate my account's encryption key' (make a note of the warning) for maximum security.

It's also worth visiting **https://haveibeenpwned.com** as well as other reputable sites like **https://monitor.firefox.com** to enter your email address to see if that's been involved in any potential hacking or data breaches.

**Nick Peers**

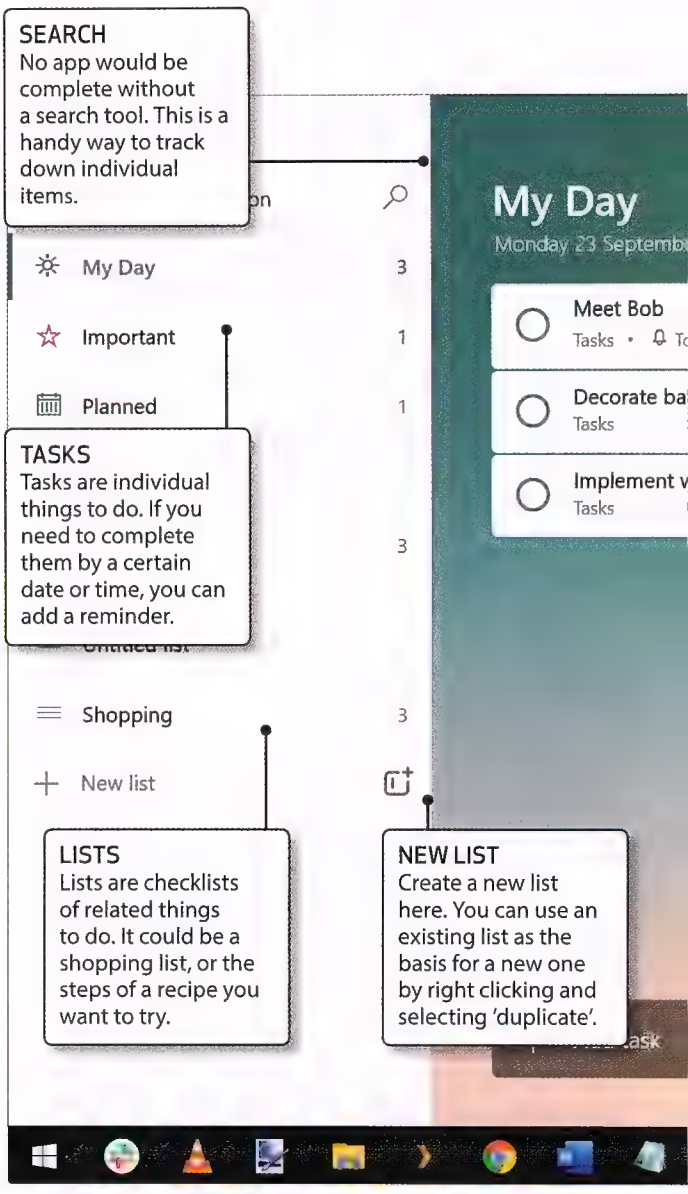
# Manage lists with To Do

## Keeping on top of what you need to do and remember is a breeze thanks to Microsoft To Do.

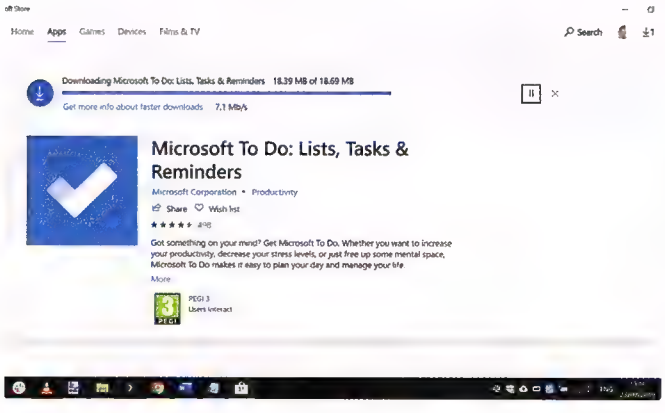
Whether a simple shopping list or the complex steps for a project you are working on, just about everyone can make use of a to-do app. Being able to make a list and tick things off as you go is an effective way to keep track of what you're doing, so you can better manage your time.

Microsoft has its own to-do app, appropriately named Microsoft To Do. It is free for Windows, Android, iOS and macOS, as well as online. You can create checklists so you can tick things off as you do them, and cross-platform synchronisation means you can access them from different devices – such as your computer and your phone.

Microsoft To Do is about more than just simple lists, however. You can also use it to store notes, create alerts, and manage recurring items – as you will see as we explore this incredibly useful tool.

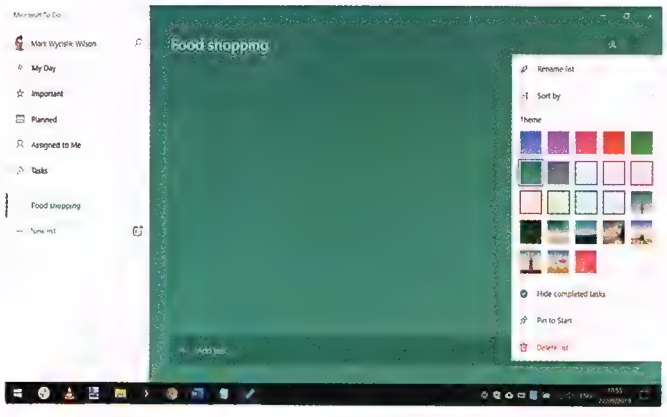

SEARCH
No app would be complete without a search tool. This is a handy way to track down individual items.
My Day
Important
Planned
Shopping
New list
TASKS
Tasks are individual things to do. If you need to complete them by a certain date or time, you can add a reminder.
LISTS
Lists are checklists of related things to do. It could be a shopping list, or the steps of a recipe you want to try.
NEW LIST
Create a new list here. You can use an existing list as the basis for a new one by right clicking and selecting 'duplicate'.
My Day
Meet Bob
Tasks

# Your first steps with Microsoft To Do




### 1 DOWNLOAD AND INSTALL TO DO

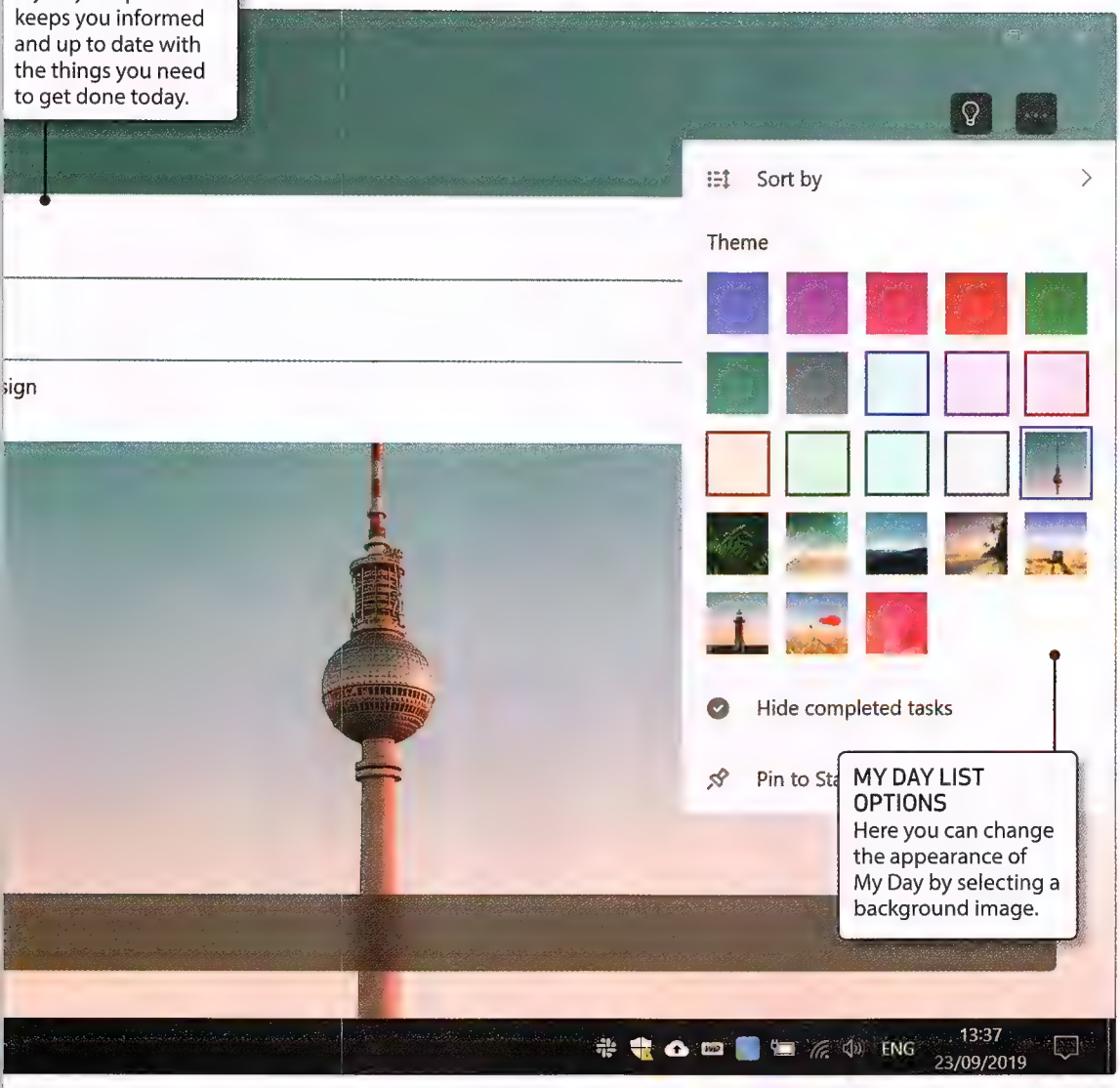
The Microsoft To Do app is available for free download in the Microsoft Store. Launch the Store app from the Start menu or taskbar shortcut, search for "Microsoft To Do" and click the Install button. You should be automatically signed into your Microsoft account the first time you launch the app, but if not you can do it manually – this helps with synchronisation between devices.




### 2 CREATING LISTS

Lists are at the heart of To Do, and you can create one by clicking the New list button label in the left-hand panel. Type a name for the list to make it easier to identify when you later create more. Click the '…' button to the upper right, and you can choose a colour theme which not only changes the main background colour, but also the text in the list of lists.

**MY DAY**
My Day is a panel that keeps you informed and up to date with the things you need to get done today.



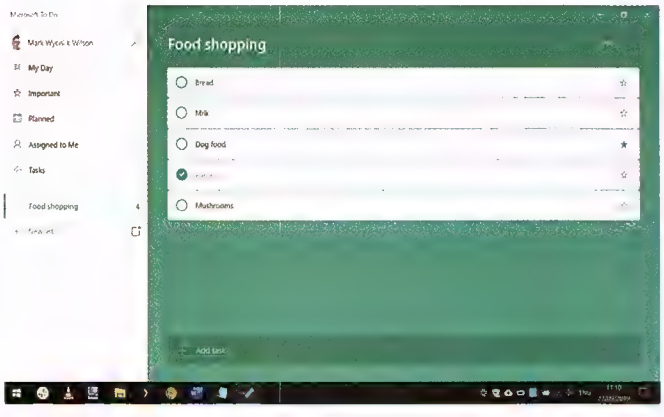

**MARK'S BEST TIP**
If you have used Wunderlist, there is a handy option to import your old data when you first launch the new app.

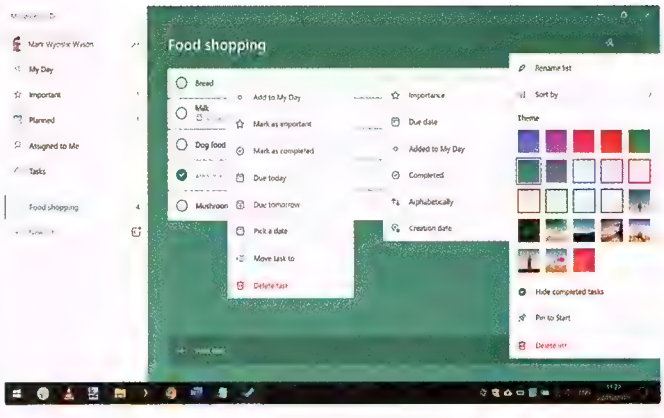
**JARGON BUSTER!**

**WEB APP**
In addition to the downloadable apps for various platforms, Microsoft To Do is also available as a web app – an interactive website that functions just like an application which you can access from any computer.

**PIN TO START**
Opting to pin My Day to Start means that your tasks for the day will be added to a Live Tile in the Start menu, so it is easily accessible at all times.

**LIST SHARING**
Microsoft To Do lets you invite other people to collaborate with you on lists. When a list is shared, others can not only see what needs to be done, but also make changes and additions to it.



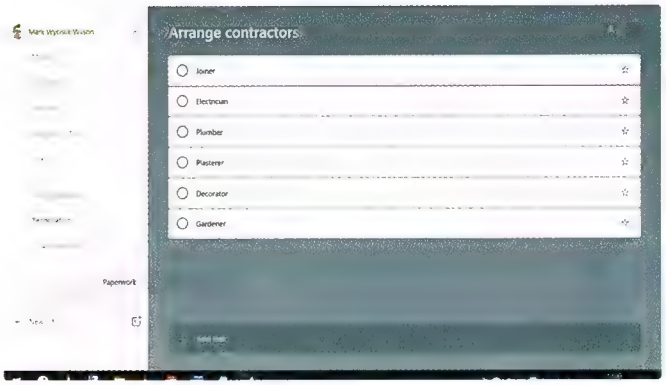




## 3 ADDING TASKS TO LISTS

A blank list is of little use, so you'll need to add items. To Do refers to items on a list as a task, and you can start building up your list by clicking the Add task button that appears at the bottom. Add as many items to the list as you need. You can use the Star icon to the right to mark something as important, and click the checkbox to the left to mark it as complete.

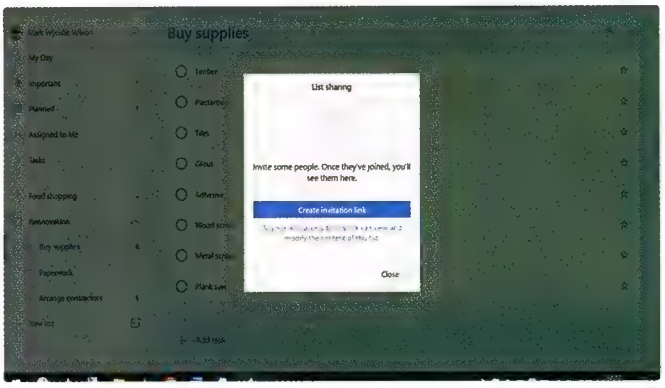
## 4 OTHER LIST OPTIONS

If you right click on an item on a list, you can do things such as moving it to the My Day section for increased visibility, and set a due date. In the Settings menu you accessed in the previous step, you can opt to re-order the list based on the due dates assign to entries, and also choose to hide completed items – this can be particularly handy when it comes to shopping lists.



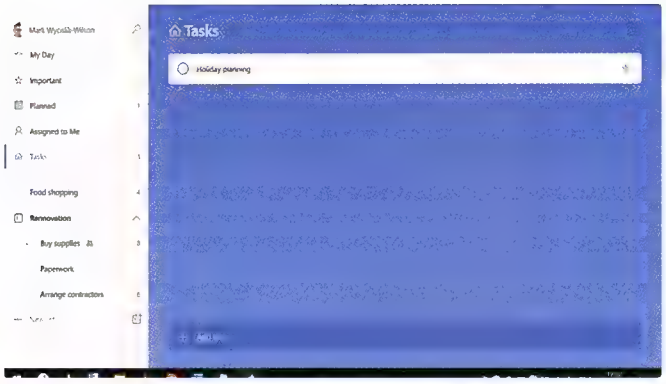

## 5 GROUPING LISTS

Sometimes it makes sense to group lists together, perhaps to break a large project down into smaller components, but still keep them linked. It's a great idea for things you may be working on at work, a building project, or an event. Click the button to the right of the New list label to create a new group which you can then name. You can create and drag new sub-lists into the group.



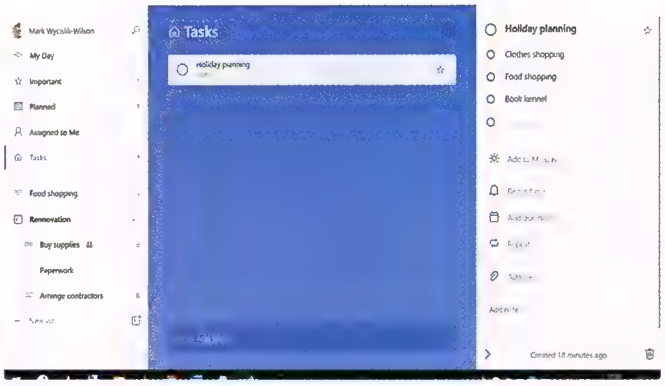

## 6 SHARING LISTS

In the case of shopping lists or larger projects, it can be helpful to have collaborators – and To Do enables you to share lists with others. In the upper right-hand corner of a list, next to the '...' Settings button, you'll see the 'Share list' button. Click it, and you get an invitation link you can send to people. If they accept, they will be able to not only see, but also edit the list.



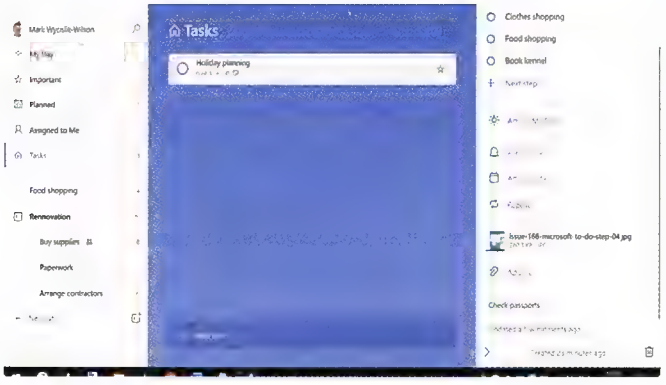

## 7 CREATING TASKS

Tasks are rather more versatile than lists for a number of reasons. Tasks can be made up of multiple steps, and you have the option of attaching files and notes to them – all perfect for larger, more complicated projects. It is also possible to assign reminders to tasks so you don't miss an important deadline. Click Tasks to the left and then click Add task.



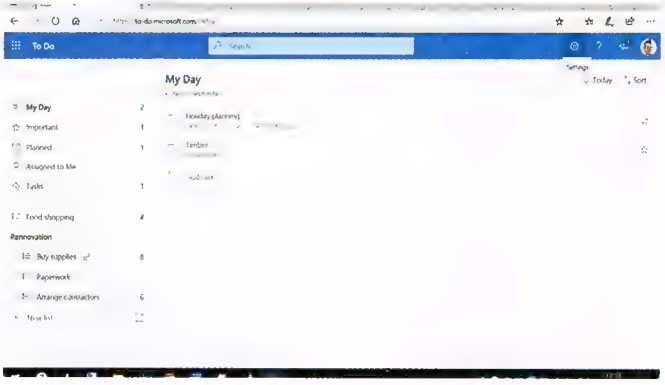

## 8 ADDING TASK STEPS

Click the task you have created, and a panel will appear with further options. By clicking 'Add step' and 'Next step' in this panel, you can add sub-tasks to a task which can be ticked off one by one. You'll notice that the main task entry indicates how many steps it has, and how many have been completed. Tasks can also be customised with coloured backgrounds like lists.




## 9 REMINDERS AND ATTACHMENTS

If you need to complete tasks to a deadline, To Do lets you add a reminder. In the right-hand panel, use the 'Remind me' option to add an alert, or just set a due date. You also have the option of making tasks into recurring items. Towards the bottom of the panel you will find the option to add notes and even attach files which you may need in the course of working on the project.




## 10 MICROSOFT TO DO ONLINE AND ON MOBILE

The beauty of To Do is that you can access it from just about anywhere. You set things up on your desktop or laptop, but the Microsoft To Do website (**to-do.microsoft.com**) is essentially identical to the downloadable app. There are also versions of To Do for Android and iOS, so you can use your smartphone to check your shopping list when you're in the supermarket.

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Screen Time
Screen Time: On
Turn Off...
Share across devices
You can enable this on any iPhone, iPad or Mac signed in to iCloud to report your combined screen time.
Use Screen Time Passcode
Use a passcode to secure Screen Time settings and to allow for more time when limits expire.
Kenny Hemphill
App Usage
Notifications
Pickups
Downtime
App Limits
Always Allowed
Content & Privacy
Options
MacBook Pro

# Master Screen Time on Mac

## Keep an eye on how much time you're spending on your devices.

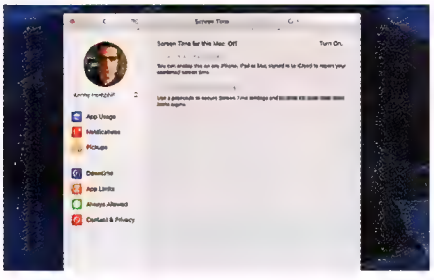
Screen Time, Apple's tool for checking the amount of hours you spend staring at a screen has been around since iOS 12, and it's now made its way to the Mac. That means you can not only configure it from your Mac, but can include usage of the Mac, and any other Mac running macOS Catalina that's linked to your Apple ID, in the calculation of total screen time.

In addition to monitoring how much time you spend in different apps, you can schedule downtime; set limits for apps, groups of apps, and websites; and use Family Sharing to set these limits up for your children.

By grouping certain apps, you can ensure that you or your children can only use a device to work or study, say, rather than for gaming or watching YouTube at specified times. And you can choose to be alerted when you are nearing the screen time limit so that you can actually finish what you're doing. In a pending update, you'll also soon be able to set limits on who your children communicate with during the day and in downtime. **Kenny Hemphill**

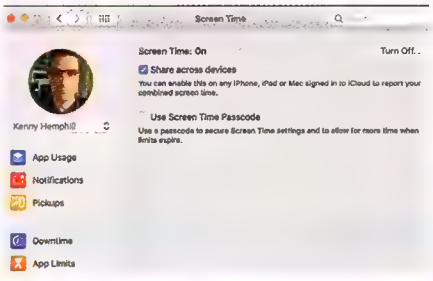
# how to

## Set up Screen Time on your Mac



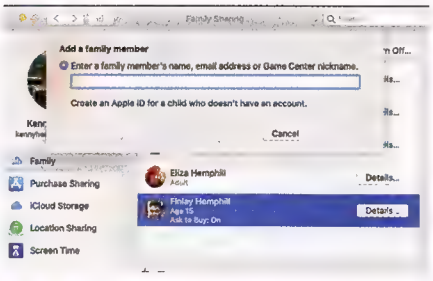
### 1 TURN ON SCREEN TIME

Go to System Preferences and choose Screen Time. Click Options at the bottom left of the window. If 'Screen Time for this Mac' is off, click Turn on. You can then choose whether to enable it on all your devices or set a passcode.


Screen Time
Screen Time: On
Turn Off..
Share across devices
You can enable this on any iPhone, iPad or Mac signed in to iCloud to report your combined screen time.
Use Screen Time Passcode
Use a passcode to secure Screen Time settings and to allow for more time when limits expire.
Kenny Hemphill
App Usage
Notifications
Pickups
Downtime
App Limits

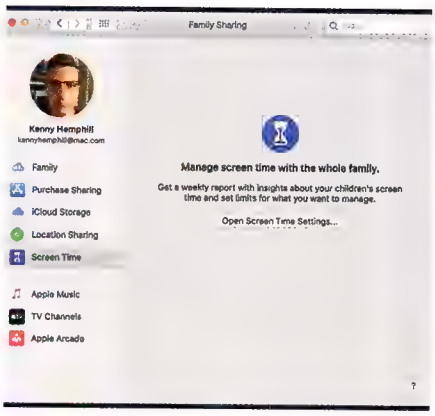
### 2 SWITCH ON FOR ALL DEVICES

To use Screen Time on all your devices, check the box next to 'Share across devices'. If you want to use a passcode to protect access to Screen Time settings or enabling more time, check that box (see step 12).



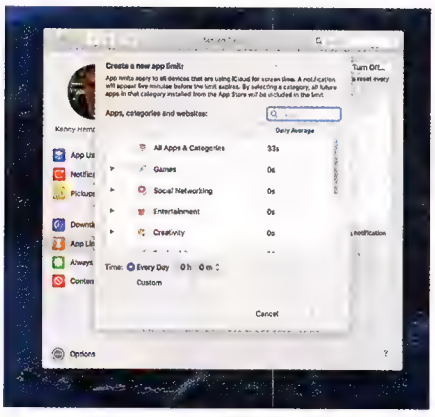

### 3 ENABLE FAMILY SHARING

If you haven't already set up Family Sharing, go to System Preferences > Family Sharing > Family and add a child. Once they've accepted, go to the Screen Time section of Family Sharing and select their name.




## 4 TURN ON FAMILY SHARING

From System Preferences > Family Sharing, choose Screen Time, then Open Screen Time Settings. Choose your child's name from the menu in the top-left corner. Click the Options button, then choose Turn On.

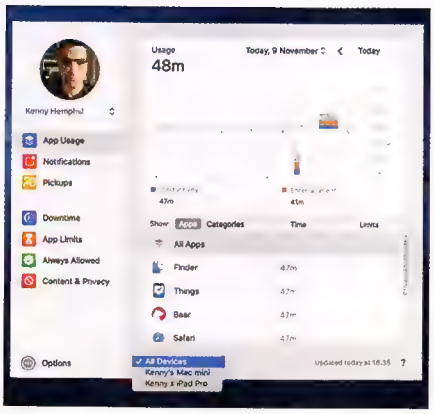



## 7 SET APP LIMITS

Click on App Limits and click Turn On then '+'. Choose the categories you want to limit, then the amount of time you want to allow for them. Click Done. To edit the apps in a category, click on it then Edit Limit followed by Edit Apps.

## 10 LIMIT ACCESS

Select Content & Privacy and click Turn On. Starting with Content, click on each tab in turn and go through the list of options, checking the box next to those you want to block access to. The Other tab only affects iOS devices.

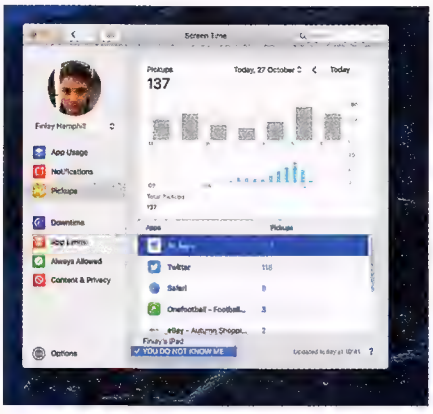



## 5 TRACK SCREEN USAGE

In the Screen Time pane, click on App Usage. You'll see the usage for the current day. Go to the date in the top-right corner to switch to a different day, or click on All devices (bottom left) to switch to a specific device.

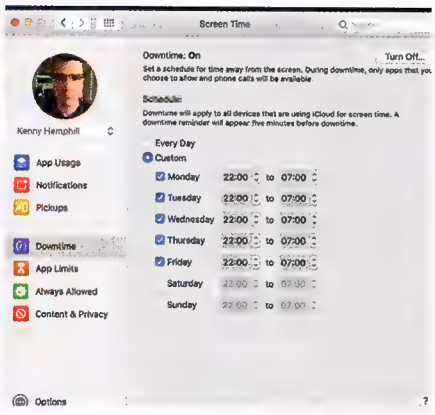
## 8 SET LIMITS FOR A CHILD

Go to the top left of the Screen Time sidebar and choose your child's name. Click Options, then Turn On. Go through steps 2-7 to set limits for apps and schedule downtime. You can also monitor your child's usage from App Usage.



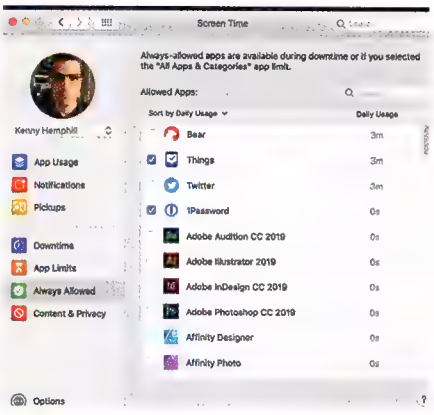

## 11 CHECK PICKUPS

You can check how many times a device has been 'picked up' and how many times an app has been used. Choose a user, then Pickups, and a device. You'll see a list of apps and how many times each has been used.




## 6 SCHEDULE DOWNTIME

Downtime prevents you using all apps except those you exclude (see step 9). In System Preferences > Screen Time, click on Downtime. Click Turn on. Choose either every day or Custom and then use the controls to set time limits.

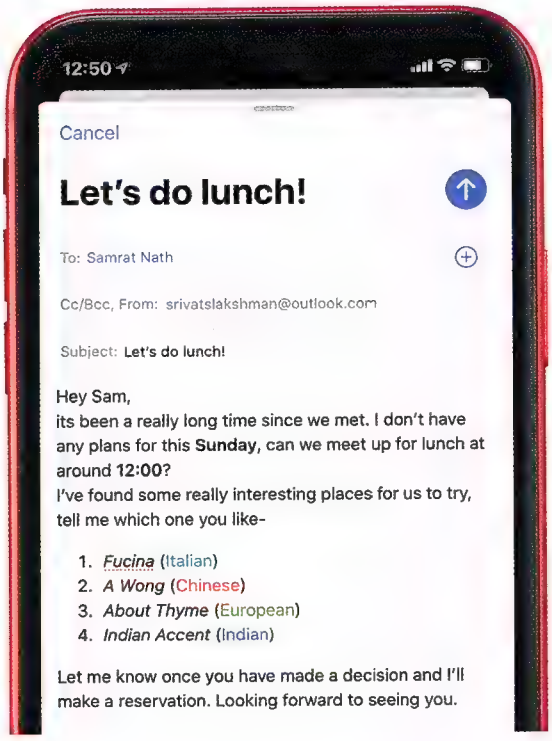



## 9 ALWAYS ALLOW SOME APPS

Choose Always Allowed, then either search for an app or scroll down the list and check the box next to those you want to always be able to open up. The apps you've specified here will override any other settings you've configured.

## 12 SET A PASSCODE

Choose the name of a child for whom you want to use a passcode. Click Options, then select Use Screen Time Passcode. Type in a passcode. Settings for this child can now only be changed by typing in that passcode.


12:50
Cancel
Let's do lunch!
To: Samrat Nath
Cc/Bcc, From: srivatslakshman@outlook.com
Subject: Let's do lunch!
Hey Sam,
its been a really long time since we met. I don't have any plans for this Sunday, can we meet up for lunch at around 12:00?
I've found some really interesting places for us to try, tell me which one you like-
1. Fucina (Italian)
2. A Wong (Chinese)
3. About Thyme (European)
4. Indian Accent (Indian)
Let me know once you have made a decision and I'll make a reservation. Looking forward to seeing you.

# Do more with Mail in iOS 13

## Edit fonts, add drawings and do much more with new tools in the Mail app.

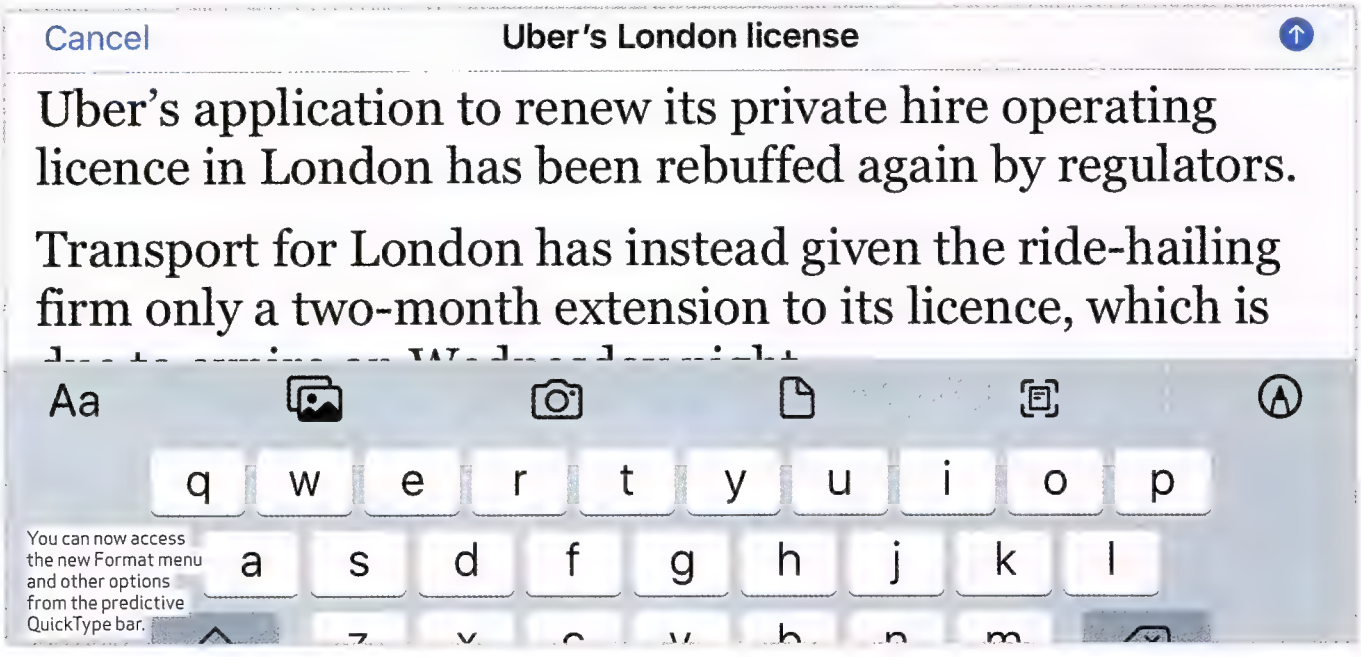
The Mail app has become a much more functional and powerful tool with every upgrade, and iOS 13 brings some amazing new features.

Apple has now ported over the Format menu from its iWork suite on iOS, enabling you to change fonts, format text, add indents and bullet points, and pick from nearly 100 colours, all from a single easy-to-access menu. And there's now support for third-party fonts, so you can really customise your mails and make them stand out.

### QUICKER ACCESS

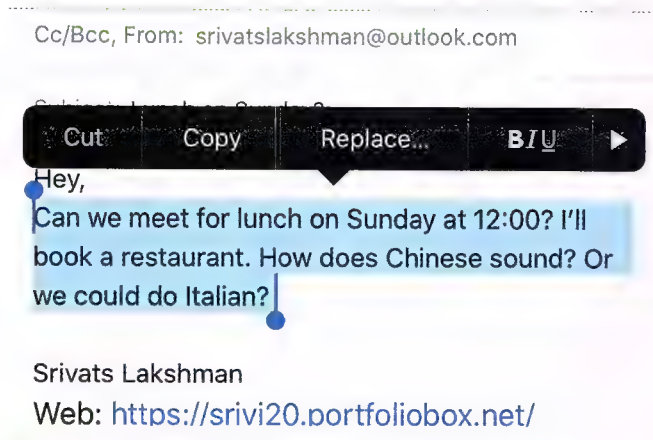
iOS 13 also adds shortcuts to access the gallery, camera, Files app, document scanner and sketches from the predictive QuickType bar on the top of your keyboard. Simply tap the arrow on the right side of the bar, or swipe left on the bar to see these options. You can still access them as you would in previous iOS versions – by double-tapping to highlight a word, or triple-tapping to highlight a sentence to bring up the formatting options.

Apple has also added several new gestures to iOS and iPadOS. A three-finger pinch copies text; spreading three fingers back out pastes text. Doing the copy gesture twice will cut text. You can also swipe left with three fingers to undo, and swipe right to redo. Naturally, all these gestures are a little easier to use on a larger iPad screen, but they can be used on the iPhone as well. **Srivats Lakshman**


Cancel
Uber's London license
Uber's application to renew its private hire operating licence in London has been rebuffed again by regulators.
Transport for London has instead given the ride-hailing firm only a two-month extension to its licence, which is
Aa
q w e r t y u i o p
a s d f g h j k l
You can now access the new Format menu and other options from the predictive QuickType bar.

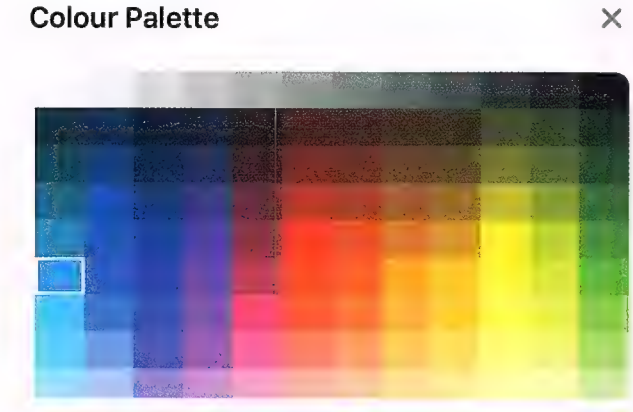
# how to

## Format text in Mail.



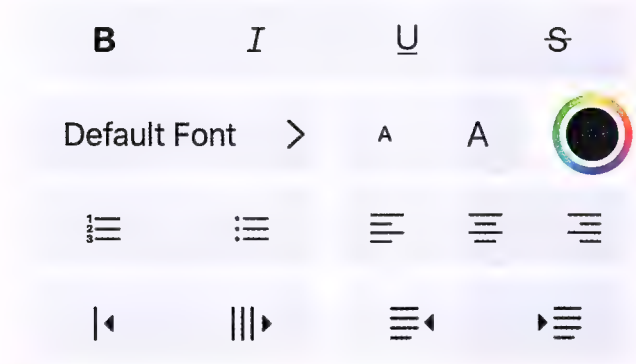

**1** OPEN THE FORMAT MENU

Within an email, select the word, sentence or paragraph you want to format to bring up the Format menu. From here you can change fonts, edit text size, add indentation, change alignment and choose a colour for your text.



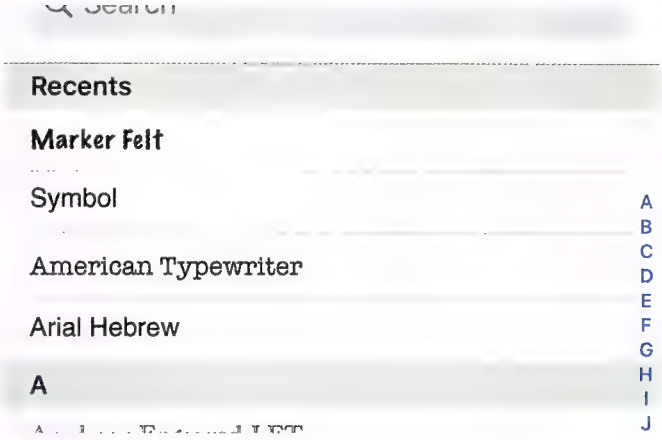

**3** PLAY WITH COLOUR

If you want to add a splash of colour to your mails, use the new colour picker. At the centre of the circular picker, you will see the current colour; by tapping it you can bring up a palette with 96 colour options.



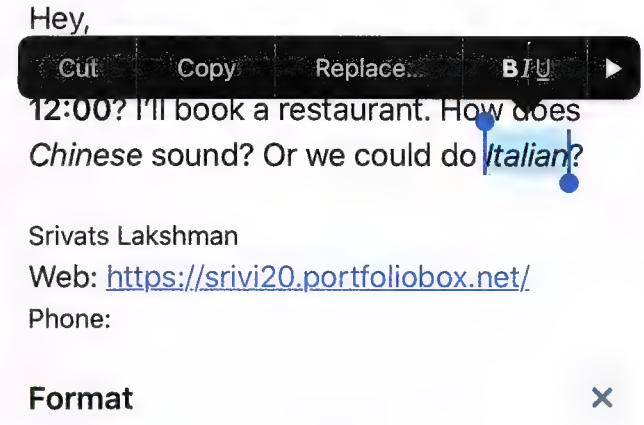

**5** ADD INDENTS AND BULLETS

If you have to compose a long email, you can add indents to make it easier to digest by pressing the 'I' button. If you want to add a list, there's also a handy new numbered or plain bullet option to choose from.



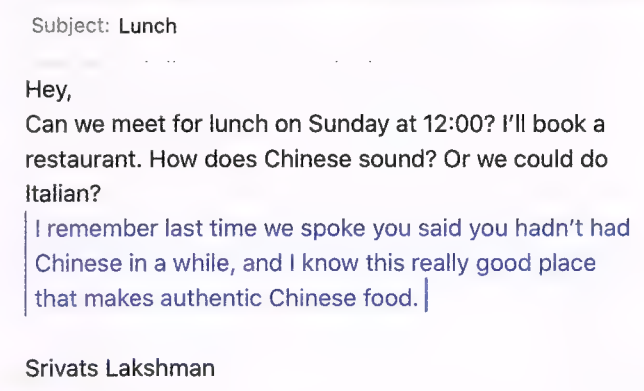

**2** CHANGE FONTS

Once you have selected the text, click on the box that says Default Font. Apple sets the default to Helvetica Neue, but you can change it to any of the built-in fonts, or use fonts from a third-party app from the App Store.




**4** BOLD, ITALICISE OR UNDERLINE

In previous versions of iOS, the only way to access bold, italicise and underline options was through the toolbar. Mail now allows you to access these options, and the new strikethrough option, from the Format menu.


Subject: Lunch
Hey,
Can we meet for lunch on Sunday at 12:00? I'll book a restaurant. How does Chinese sound? Or we could do Italian?
I remember last time we spoke you said you hadn't had Chinese in a while, and I know this really good place that makes authentic Chinese food.
Srivats Lakshman

**6** DO MORE

The Format menu also enables you to change the size of your text, indent quoted text for replies and threads and even change the text alignment (left-justified, centred or right-justified) of your mails.

# Text-only social media

As a near-permanent resident of the terminal, Shashank Sharma even manages social media without a GUI.

With the soaring popularity of the Linux CLI – with even new users willing to embrace what was once considered the exclusive domain of power users – it is perhaps time to create a list of rules of the terminal. The next two pages will convince you why the most obvious first rule must be: If it exists, it's possible to do it from the terminal. No exceptions!

You occasionally need to take a break from news and work and check in with your peers and friends on one of the popular social media services. But can you do that from the confines of a terminal, so as to not reveal your lack of decorum to your boss and colleagues?

## TERMINAL REDDIT

The self-proclaimed "front page of the internet" is home to dedicated communities on just about every topic. You'll find passionate discussions on varied topics such as cycling, programming, gardening, motorcycle repair, the command line and more. With Terminal User Interface for Reddit (TUIR), you can read messages and even post comments from the comfort of the terminal.

TUIR started as a fork of the Reddit Terminal Viewer (RTV) utility, as this is no longer maintained by its developer. You can install TUIR with the `pip install tuir` command. The project is installed in the ~/.local/bin directory, so you'll have to add it to your $PATH. You can do that by editing the ~/.bashrc file and adding `export PATH=$HOME/.local/bin:$PATH` to it. You must run the `source ~/.bashrc` command after editing the ~/.bashrc file.

The default configuration file can be copied into the ~/.config/tuir/ directory with the `tuir --copy-config` command. The config file has all the pertinent defaults such as the default sub-Reddit to open, or whether you want to remain logged in across sessions. You can make changes if needed using your favourite text editor, but the defaults should suffice for most users.

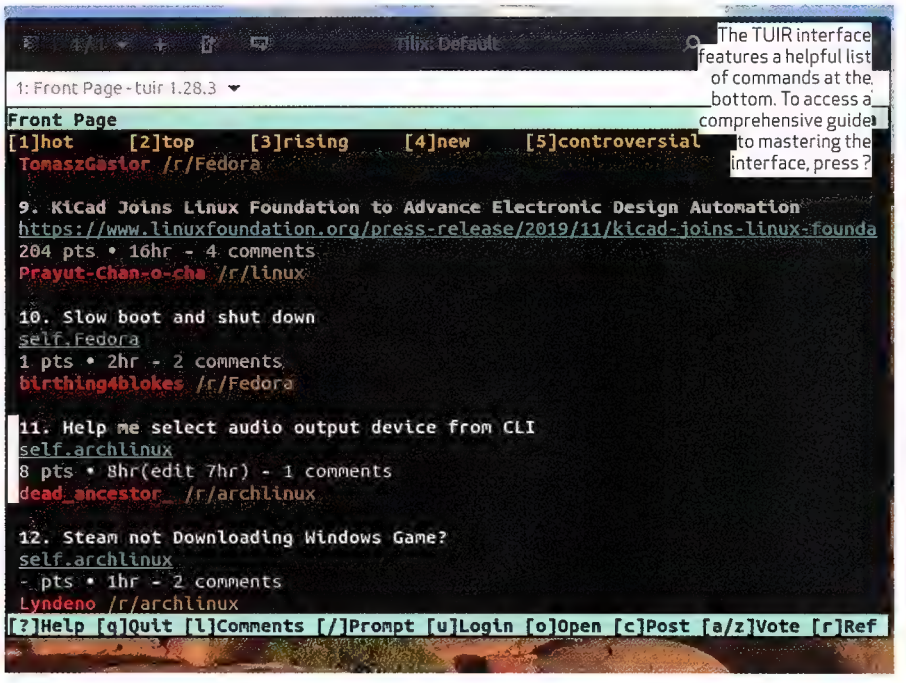
Users frequently share a variety of media on Reddit, and you can define the applications you want to use to open these files. Run the `tuir --copy-mailcap` command which will create the ~/.mailcap file, with various defaults for different file types, but you can make changes if required. Finally, run the `tuir --enable-media` command. TUIR will now open images and media files in the defined application.

When you run `tuir`, you can start browsing your favourite sub-Reddits without logging in – but press U to log in. You'll be redirected to the Reddit website, where you'll have to enable access to third-party apps, before you can login to Reddit via TUIR.

The utility supports a variety of keybindings tohelp you interact with your peers and access your subscribed communities. Press ? for a list of these.

## RAINBOW STREAM

Despite attempts by various platforms to duplicate its success, Twitter continues to remain polarisingly popular with the masses. If you already have an account on the micro-blogging website, you can use Rainbow Stream to access your


1: Front Page - tuir 1.28.3
Front Page
[1]hot [2]top [3]rising [4]new [5]controversial
TomaszGasior /r/Fedora
9. KiCad Joins Linux Foundation to Advance Electronic Design Automation
https://www.linuxfoundation.org/press-release/2019/11/kicad-joins-linux-founda
204 pts • 16hr - 4 comments
Prayut-Chan-o-cha /r/linux
10. Slow boot and shut down
self.Fedora
1 pts • 2hr - 2 comments
birthing4blokes /r/Fedora
11. Help me select audio output device from CLI
self.archlinux
8 pts • 8hr(edit 7hr) - 1 comments
dead_ancestor /r/archlinux
12. Steam not Downloading Windows Game?
self.archlinux
- pts • 1hr - 2 comments
Lyndeno /r/archlinux
[?]Help [q]Quit [l]Comments [/]Prompt [u]Login [o]Open [c]Post [a/z]Vote [r]Ref

The TUIR interface features a helpful list of commands at the bottom. To access a comprehensive guide to mastering the interface, press ?

## IRC chat with Irssi

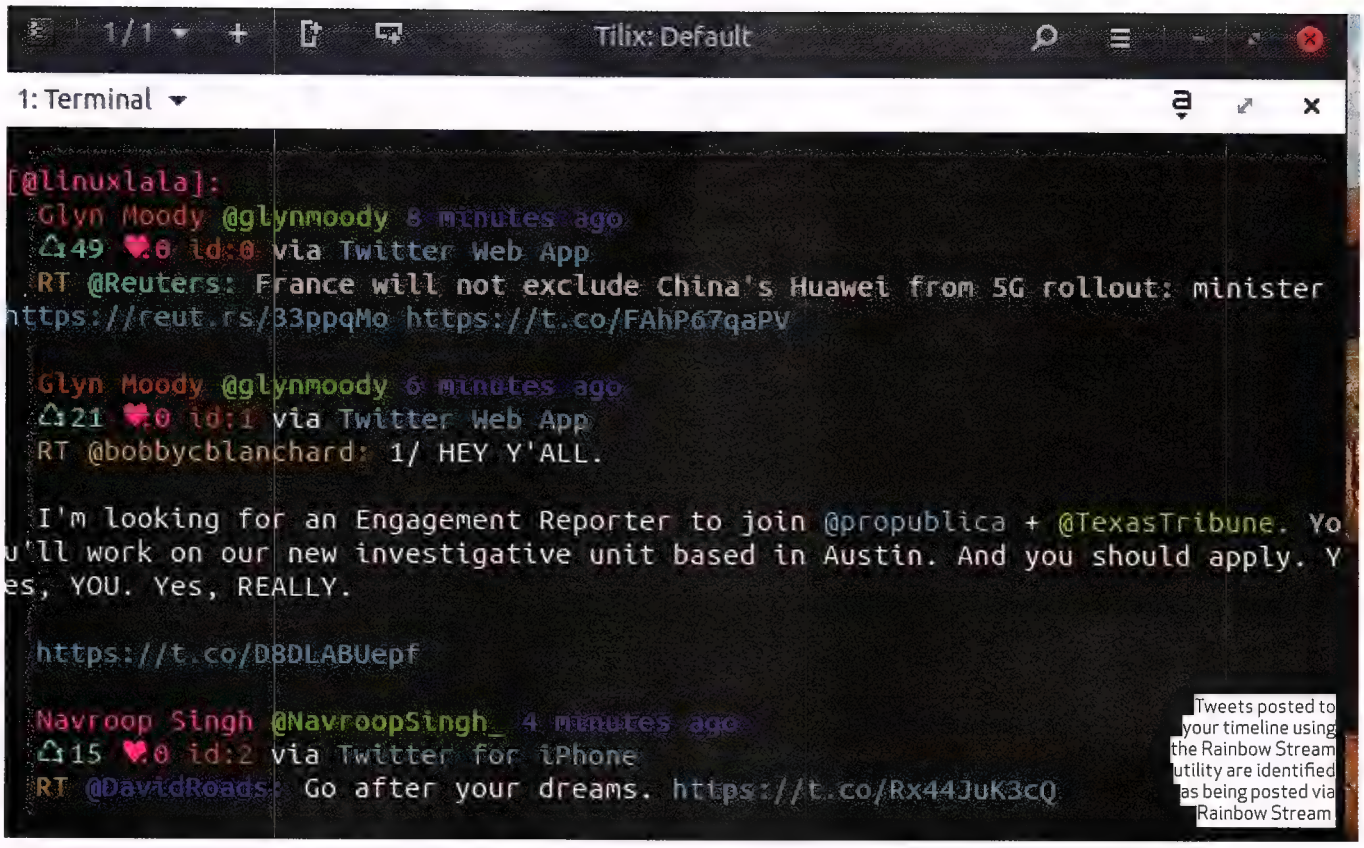
Many Linux programs, be they distributions or applications, still use IRC as a means of connecting with the user community. You'll often find many developers on these IRC channels and there's a good amount of help and information to be found if you can make your way to IRC.

The Irssi application is quite popular and you'll find it in the software repositories of most modern desktop distributions. When you run Irssi for the first time, the tool will use the settings from your current user account to populate its config file. Your username will be your nickname, and your full name will be used as the real name.

You can define a custom nickname with the `SET nick` command. Next, you must register your nickname to ensure it's not used by anyone else. Run the `/msg nickserv register <password> <email>` command to do so. Follow the instructions in the email you receive to complete the registration.

With that done, it's time to connect to a server. Run the `/NETWORK LIST` command for a list of servers configured by default. Most open source projects such as Ubuntu, Linux Kernel, Fedora, Gnome and so on are on the Freenode server. You can connect to a server by running the `/connect freenode` command.

After connecting to a server, you can now join a channel with the `/join <channel name>` command.


1/1
Tilix: Default
1: Terminal
[@linuxlala]:
Glyn Moody @glynmoody 8 minutes ago
49 0 id:0 via Twitter Web App
RT @Reuters: France will not exclude China's Huawei from 5G rollout: minister
https://reut.rs/33ppqMo https://t.co/FAhP67qaPV
Glyn Moody @glynmoody 6 minutes ago
21 0 id:1 via Twitter Web App
RT @bobbycblanchard: 1/ HEY Y'ALL.
I'm looking for an Engagement Reporter to join @propublica + @TexasTribune. Yo
u'll work on our new investigative unit based in Austin. And you should apply. Y
es, YOU. Yes, REALLY.
https://t.co/D8DLABUepf
Navroop Singh @NavroopSingh_ 4 minutes ago
15 0 id:2 via Twitter for iPhone
RT @DavidRoads: Go after your dreams. https://t.co/Rx44JuK3cQ
Tweets posted to your timeline using the Rainbow Stream utility are identified as being posted via Rainbow Stream.

timeline, tweet to your followers, retweet, retweet with comments, open a complete thread and more.

You can install the utility with `sudo pip3 install rainbowstream`. Depending on your distribution, you might have to install some additional packages if they aren't already available: libjepg and libjpeg-devel. These can be installed using the usual software repositories of your distribution.

Once installed, you can launch the utility with the rainbowstream command. As with TUIR, you will have to enable third-party access from your Twitter account and provide the PIN for two-factor authentication before you can begin using the utility independently of a GUI.

Your custom tweaks to its configuration, such as the theme to use, the number of records to display for your search terms and so on are controlled via the ~/.rainbow-config.json file.

Rainbow Stream provides all the pertinent details for each tweet such as the number of retweets, likes and so on. Although it's not apparent, the blinking cursor at the bottom of the interface is a command prompt. You can run different commands such as `trend` to view the global trends, while `view @username` will show the specified user's timeline. You can run the `t This is a tweet from the Linux terminal` command to post tweets.

Each tweet in the timeline displayed by Rainbow Stream is assigned a unique ID, which can be used to interact with the selected tweet. For instance, the command `rt 8` will retweet the tweet with the ID of 8. You can similarly run the `quote 8 <comment>` command to quote the tweet with your own comments.

Rainbow Stream can do just about everything you'd expect from a Twitter client. For a complete list of supported functions, run the `h` command. For specific help with different functions such as `list`, `tweet`, `message` and more, run the `h tweets` command or the h list command for help relating to the tweet and list functions respectively.

## TELEGRAM-CLI

As with the other utilities, using Telegram-cli to access your Telegram messages is quite a breeze. The utility is available as a Snap package so you don't have to worry about chasing after dependencies to get it to work. You can install it by running `sudo snap install telegram-cli`. The next step is to connect the utility with your phone, so run the `telegram-cli --phone` command. You'll be prompted to provide a mobile number. Make sure you enter your country code along with the mobile number, without any hyphens or brackets. If all goes well, you'll receive a code on your phone, which you have to enter it into the utility. That's it!

You can now access all your contacts by running `contact_list` at the > prompt within the utility. Unlike most terminal applications, Telegram-cli doesn't have any interface to speak of. Except for the command prompt at the bottom, there's nothing distinguishable about the output produced by Telegram-cli.

You can run the `dialog-list` command for a list of all the groups and chats with your contacts. To select a chat or group and view the messages, you must run the `history <name>` command. Replace <name> with the name of the contact or group and the tool will display the past conversation.

## BUT WAIT, THERE'S MORE

Due to space constraints, we aren't able to cover all the projects available for different platforms. If you've never given it any thought, this might come as a surprise to you but there are projects to help you access Facebook and even Instagram using the terminal, although they aren't generally as easy to use as the ones we've looked at here.

But we haven't tried these utilities ourselves, as those platforms are more suited to fully featured graphical systems that enable you to appreciate the media content popular on these sites. (In other words, cat videos and Picard memes – *Ed*)

# 15 tips to capture better phone audio and video

Darren Yates shares the basics as well as expert tips for getting the best results when shooting with your Android (and iPhone!) device.

Whether its recording uni lectures for easier note-taking or capturing a friend's wedding for posterity, our phones have replaced so many devices we used to carry around – but that doesn't mean you can't improve your results. We've put together 15 of our best tips to boost the quality of your audio and video recordings, no matter what type of phone you have.

## VIDEO TIPS

### KNOW YOUR PORTRAIT AND LANDSCAPE

How you hold your phone when capturing video will make a big difference in how you best use that video later on. Hold it in the vertical or 'portrait' orientation and the video is probably best used for social media. But for more cinematic applications, rotate your phone and hold it in 'landscape' mode. Your PC, laptop and TV are all landscape-oriented devices, so it makes sense to maximum that screen area and shoot your videos in landscape mode. Your audience will love it.

### USE MAXIMUM FRAME SIZE

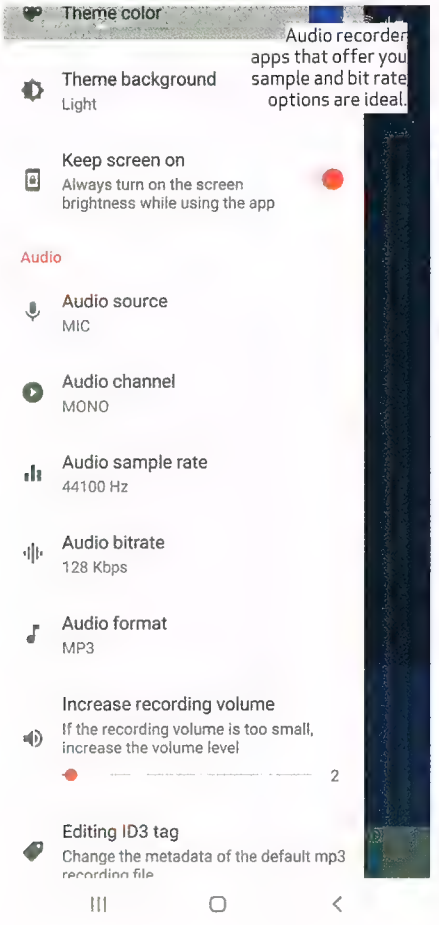
To capture the best video your phone can muster, set the video frame size to the highest 16:9-aspect ratio option available. Many low-end phones may be limited to 1280x720-pixels, while mid-range phones usually reach 1920x1080-pixels. Top-drawer models will generally give you one or more '4K' options. Using maximum frame size requires more storage space, even more battery life, but it'll give you the maximum quality your phone has to offer. Remember – you can always reduce the quality of a video by shrinking the frame size after you've captured it. You can't put the quality back again later if it's not there to start with.

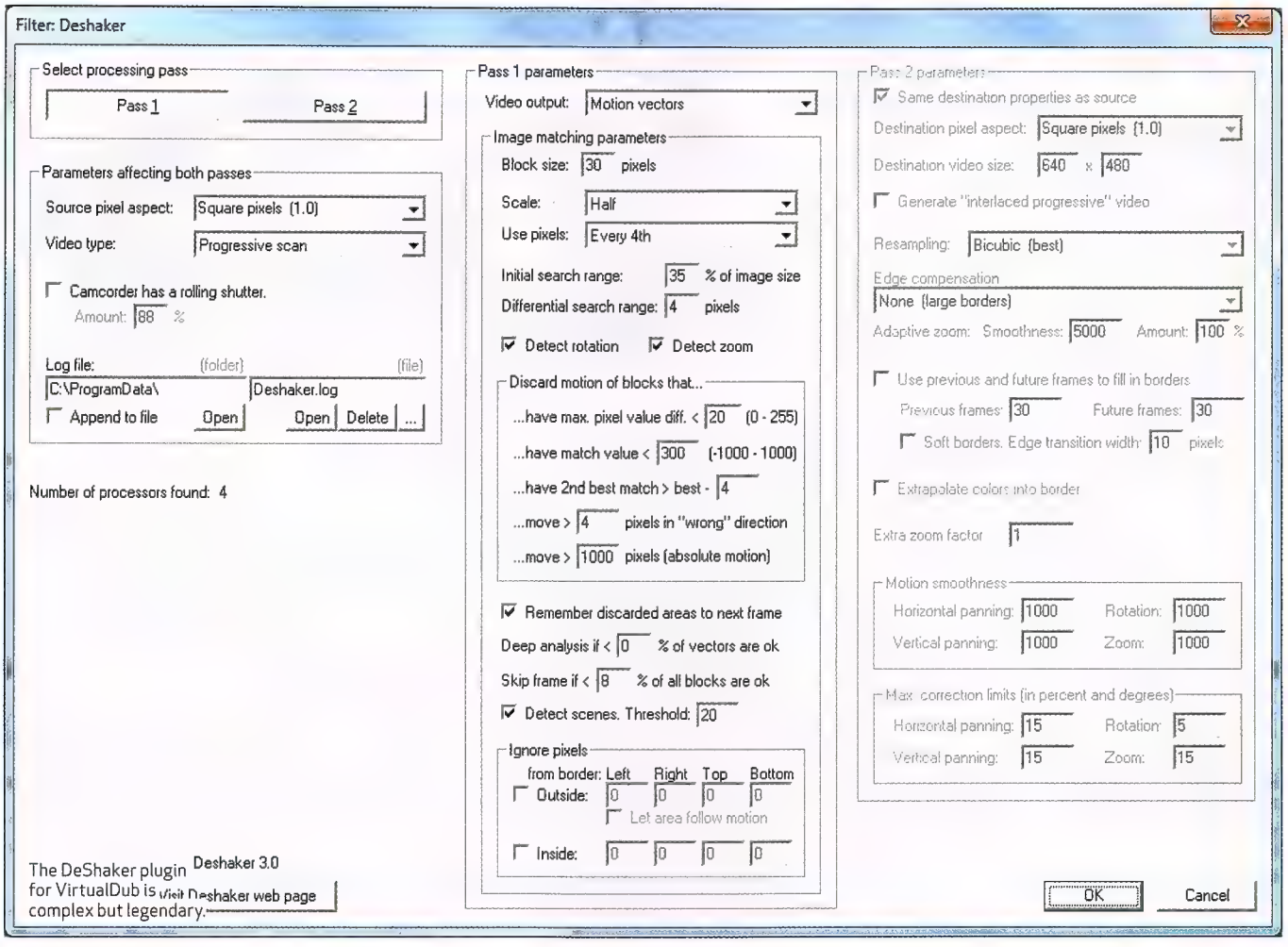
### FIND A BETTER CAMERA APP

Android's built-in Camera app does a fair job, but lacks user options, particularly for video bit rate. It's one of those tricky parameters that affect not just the quality of the video you capture, but also the amount of storage your video needs, so not having the option to set the video bit rate is a problem. For example, the video bit rate for capturing 1,280x720-pixel video with the Camera app on a Samsung Galaxy A30 is 12.1-megabits-per-second (Mbps) – that's 90MB of space per minute, which is excessive for that frame size. In contrast, YouTube needs only 3.5Mbps for high-quality 1,920x1080-pixel video. Open Camera is arguably the best camera app on Google Play – it's free and puts you in the director's chair, giving you control over many settings – including video bit rate. For longer captures, I'd shoot 1,280x720-pixel video at no more than 2Mbps, 1,920x1,080-pixel video at 5Mbps and 4K video at 10Mbps using H.264 compression, increasing those rates for shorter, more purposeful clips. In any case, Open Camera wins.

### BE CAREFUL WITH DIGITAL ZOOM

It's natural to want to zoom the lens to best frame your shot. The problem with most phones, however, is that digital zoom is often the only option and involves the phone using the centre-most pixels of the image sensor and digitally magnifying them back up to the full frame size. Yes, it does zoom, but the more you zoom, the more pixels you're throwing away, leaving fewer actual pixels with any real image data. In short, it's sometimes called the 'crop




Filter: Deshaker
Select processing pass
Pass 1
Pass 2
Parameters affecting both passes
Source pixel aspect: Square pixels (1.0)
Video type: Progressive scan
Camcorder has a rolling shutter.
Amount: 88 %
Log file: (folder) (file)
C:\ProgramData\ Deshaker.log
Append to file
Open
Open
Delete
...
Number of processors found: 4
The DeShaker plugin for VirtualDub is complex but legendary.
Deshaker 3.0
Visit Deshaker web page
Pass 1 parameters
Video output: Motion vectors
Image matching parameters
Block size: 30 pixels
Scale: Half
Use pixels: Every 4th
Initial search range: 35 % of image size
Differential search range: 4 pixels
Detect rotation
Detect zoom
Discard motion of blocks that...
...have max. pixel value diff. < 20 (0 - 255)
...have match value < 300 (-1000 - 1000)
...have 2nd best match > best - 4
...move > 4 pixels in "wrong" direction
...move > 1000 pixels (absolute motion)
Remember discarded areas to next frame
Deep analysis if < 0 % of vectors are ok
Skip frame if < 8 % of all blocks are ok
Detect scenes. Threshold: 20
Ignore pixels
from border: Left Right Top Bottom
Outside: 0 0 0 0
Let area follow motion
Inside: 0 0 0 0
Pass 2 parameters
Same destination properties as source
Destination pixel aspect: Square pixels (1.0)
Destination video size: 640 x 480
Generate "interlaced progressive" video
Resampling: Bicubic (best)
Edge compensation
None (large borders)
Adaptive zoom: Smoothness: 5000 Amount: 100 %
Use previous and future frames to fill in borders
Previous frames: 30 Future frames: 30
Soft borders. Edge transition width: 10 pixels
Extrapolate colors into border
Extra zoom factor 1
Motion smoothness
Horizontal panning: 1000 Rotation: 1000
Vertical panning: 1000 Zoom: 1000
Max. correction limits (in percent and degrees)
Horizontal panning: 15 Rotation: 5
Vertical panning: 15 Zoom: 15
OK
Cancel

and enlarge' method of zoom. The result is an increasingly blocky video image the further you zoom in. However, Android phones are now starting to arrive with huge megapixel sensors – Xiaomi's CC9 Pro phone has five image sensors, one of which packs in a massive 108-megapixels. These high-MP sensors have so many pixels that implementing digital zoom without the artefacts is fast becoming a possibility, although results are very much phone-dependent.

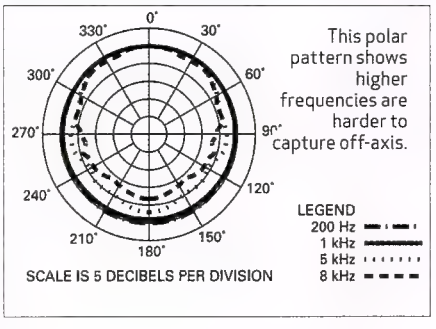
This smartphone tripod clamp can make capturing steady video easy.

## USE A TRIPOD

Once-in-a-lifetime moments won't hang around while you muck about with a tripod, but these days, we're capturing much more. The sensors in late-model phones are becoming good enough to knock out everything from interviews to training videos. Using a tripod is really the first rung up the video-quality ladder, but phones and tripods weren't designed with each other in mind. Something like a Manfrotto Universal Smartphone Clamp solves that issue. It's a spring-loaded clamp designed for smartphones up to 3.2-inches wide with two standard ¼-inch tripod screw-threads, one on the end and one on the back. For $20, it's a neat solution. The clamp has silicon rubber grips to protect your phone and we had a Motorola Moto G5 clamped in for two hours doing training videos without any problems to the phone. If you're shooting at desk level, budget mini camera tripods also start from $10.

## GET YOUR DE-SHAKE ON

If a tripod is a no-go, it doesn't mean you have to put up with video that bounces all over the shop. Post-capture video stabilisation or 'deshaking' mathematically corrects for individual frame movement, but it's hard to do well and hard to do fast on a phone. That's why it was such a shame Google killed off the video stabiliser enhancement from the YouTube Video Editor. However, there is an alternative – head to Google Play and search 'Video Stabilizer'. Despite us saying phones aren't ideally suited for video stabilisation, this app aims to do just that. User reviews are mixed, though, so try the free 'trial' version (20-second limit) and see if it works for you before spending $5 for the payware version. Adobe Premiere can also deshake video, but if you want a free PC alternative and you're up for an




This polar pattern shows higher frequencies are harder to capture off-axis.

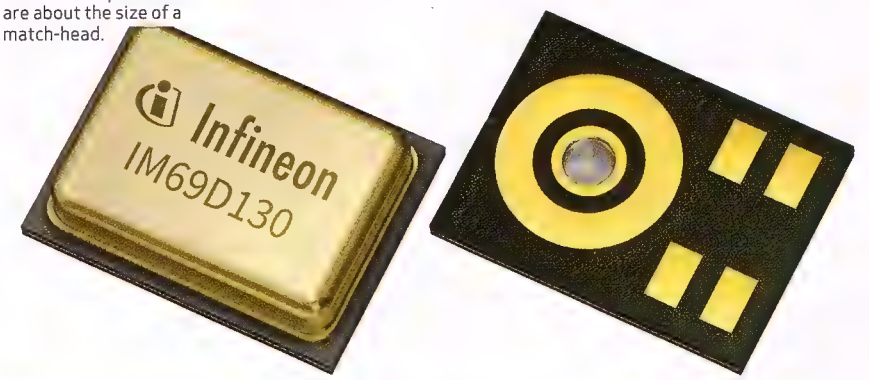
adventure, grab the old-school 'VirtualDub' video editor (**virtualdub.org**) and combine it with the exceptional (and equally complex) 'Deshaker' plugin (**guthspot.se/video/deshaker.htm**). The results can be every bit as good as you could get from YouTube, although getting them is more difficult. Still, it's free.

### NO FILTERS, NO EFFECTS

This one will probably come down to personal taste, but our tip is don't use filters or effects when shooting your videos because those filters and effects generally can't be removed later. No doubt using a cats' ears effect might have seemed like a good idea at the time, but you're probably not going to use that video later for a job application for example. Grabbing as close to raw video as your device allows leaves you with a blank canvas to be creative with after the event. If you're shooting for fun, by all means, go for your life and use whatever filters you like. But if you want to be able to re-use this video for different projects, start 'raw' and add in those tricks or treats in post-processing instead. Put it another way – you can always add filters and effects later to a video, but you can't take them out if they're baked in already.

### CLEAN THE LENS

This is a placeholder for all those things we forget to do before capturing video – like making sure the camera sensor panel is free of smeared finger-prints, charging up the phone battery before you shoot and making sure your phone has somewhere to store your takes. Its rumoured old-school Hollywood filmmakers used to smear the camera lens (or a clear filter) with petroleum jelly to create a softer focus and give their subjects a more youthful look. You'd probably get a similar effect from smearing fingers




MEMS microphones are about the size of a match-head.

> "Don't use filters or effects when shooting your videos because those filters and effects generally can't be removed later."

covered in chip grease all over the sensor panel, but we're pretty sure neither of these will do your phone much good. So, keep it clean using a glasses-cleaning cloth.

### SHOOT WITH TWO PHONES

Why shoot with just one phone? Why not two? It'll be harder to arrange those spur-of-the-moment videos, but if you're creating something more planned like training or interview videos, a second camera angle can add more interest for your audience. You might be thinking who'd use a phone to shoot corporate videos clips, but it can be done (**youtu.be/8YiwBsTQ_c0**). Your phone won't likely match a professional camera for video quality, but nor for price. The limiting factor in most phones is the image sensor itself, which is often tiny compared with those in even semi-professional video cameras. A small sensor limits your depth of field and low-light sensitivity. It also gives you a low 'dynamic range' between full brightness and complete darkness as the sensor sees it, which is also why phones often do their best work outdoors.

### SOFTEN YOUR LIGHTING

On that note, good lighting is always key to capturing better-quality video. If you're looking to use indoor video lights to brighten your subject, you probably want to avoid the typically harsh effect of sharply-defined shadow lines. Instead, using diffused lighting can give a more relaxed look. Video lights with diffusion boxes from photographic retailers usually aren't cheap, but there are plenty of DIY ideas popular on online forums. For example, some users swear by grease-proof paper. It's pretty good at diffusing light and you can increase the effect by simply adding more layers. However, although heat-resistance, it's also pretty good at burning, being the flammable material it is, so treat this tip with extreme caution. Still, they don't say 'lights, camera, action!' for nothing...

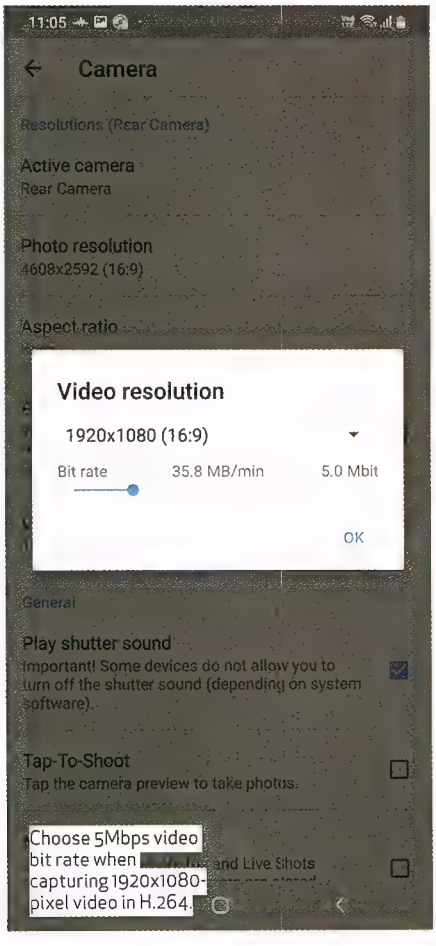
Know your 'portrait' from your 'landscape' and know when to use them.

## AUDIO TIPS

### FIND A BETTER RECORDER APP

Using your phone as an audio notetaker seems like an obvious idea, but it's becoming a less common app in more new phones. Still, even when you do get an audio recorder app bundled in, it's often a lacklustre affair. MP3 Recorder by Smart Mobile Tools is free on Google Play, offers capture in MP3 or WAV format, but importantly allows

It sounds simple but don't forget to clean the image sensor before you shoot.




Choose 5Mbps video bit rate when capturing 1920x1080-pixel video in H.264.

you to set the sample rate, number of channels, plus the audio bit rate. Hi-Q MP3 Recorder (payware) records WAV format as well, but gives you manual gain control. Both support stereo recording if your phone has two microphones.

## AVOID AUTOMATIC GAIN CONTROL (AGC)

AGC became popular with audio cassette recorders in the 1970s, by doing away with the need to set audio levels manually – the recorder did it automatically, a bit like driving a car with an automatic transmission. The problem is that as the audio level falls (during quiet passages of music for example), AGC increases the amplification factor or 'gain' to compensate. If the gain is increased too far, you start hearing the electronics' inherent background noise – the dreaded 'hiss'. What's more, as the audio levels change, this background hiss can rise and fall in intensity, which sounds distracting. For one-off notetaking, AGC is fine, but for more professional-sounding audio, look for apps that offer manual audio recording level control.

## RECORD USING CD-LEVEL SAMPLE RATE

The full audio spectrum covers frequencies between 20Hz and 20kHz, but in order to capture this range, engineer Harry Nyquist discovered you need to digitally sample the audio at twice the highest frequency you wish to record. It's one of the reasons why most music is sampled at 44.1kHz. It's also a sample rate option offered in every phone today. You can record voice-grade audio (lectures, for example) using a lower sample rate, but much like capturing video at the highest frame resolution available, capturing audio at the highest sample rate uses more storage but ensures you get the highest quality audio your phone has to offer. You can always reduce this in post-processing.

## CHOOSE AUDIO CODECS FORMAT CAREFULLY

Just as H.264 compression is important for storing large quantities of video on relatively small phone storage, audio compression formats or 'codecs', too, are important space savers. For long recordings such as lectures, recording direct to a compressed format such as MP3, AAC, Vorbis or Opus can reduce your storage requirements down to as little as 240KB per minute using a 32-kilobit-per-second (Kbps) bit rate and recording one channel (mono). However, for maximum quality, use a lossless compression format or skip the compression altogether – 44.1kHz sample rate/16-bit WAV format is essentially CD-quality. It requires 317.5MB per hour per channel, but again, will capture the best your phone has to offer while keeping your options for any post-processing.

## KNOW YOUR MICROPHONE

Smartphones use a type of microphone called 'MEMS' – Micro-Electro-Mechanical Systems – to turn sound waves into electrical energy. Every microphone has a sound capture pattern called a 'polar pattern' that's either 'omni-directional' (captures sound from any direction) or 'cardioid' (captures only a narrow angle). Many microphones are omni-directional, but even their ability to capture sound coming 'off-axis' (on an angle to its length axis) can be progressively dependent on frequency. The example polar pattern shows a traditional omni-mic – '0-degrees' is sound captured from in front of the microphone along its length axis, '180-degrees' is sound coming from behind. At a frequency of 1kHz or less, the 'full circle' pattern shows sound at this frequency is captured evenly from any direction. But at 8kHz, the microphone's off-axis sensitivity is up to 10dB lower. Every microphone has a different pattern, but the principle is the same – point your phone's microphone towards the source of sound you're recording. ■

Mini desktop tripods can be had for as little as $10.

# Play 4K UHD video on the Raspberry Pi 4

Les Pounder shows how to watch 4K videos on your Raspberry Pi 4, with Raspbian and LibreELEC.

The Raspberry Pi has disrupted many markets, and one of those is home media. The way we watch media has changed, with online streaming being a key market, that is enjoying explosive growth at the moment, largely thanks to investment in programmes by services such as Netflix. But humble optical media (DVD and Blu-ray) is still popular among home users. Why? Because it means we can have a physical copy that can never be taken from us – unlike streaming services, that can drop content based on licence agreements or just because no one's watching it or they simply go out of business and you lose all access to the content you have paid for.

For the home cinema enthusiast a central repository for all of their content can be stored is a dream come true, and the Raspberry Pi has been enabling this since 2012. With 4K now becoming the norm and with the Raspberry Pi 4 having the potential for 4K playback, we decided to take a Pi 4 4GB for a spin and see just how (and if) we can watch 4K media using it.

## NOT TO 4K?

To play 4K video content in Raspbian, we need videos using the HEVC (high-efficiency video coding) codec in order to use hardware acceleration. We will also need to play 4K videos in fullscreen mode, as running 4K video (with a bitrate of 110mbps) in a window is rather choppy. If 4K HEVC content at 55mbps bitrate is used then it's possible to run it in a window, but the X Window System will introduce some stutters during playback, especially if other applications are running.

In terms of other codecs, H.264 and MPEG-4 are supported by hardware decoding, as are MPEG-2 and VC-1 – although you'll need to buy a licence to use these, this also enables DVD playback. Media in MJPEG, VP6, VP8 and OGG Theora formats is supported using GPU-accelerated software decoders, but at DVD (480p) resolutions only.

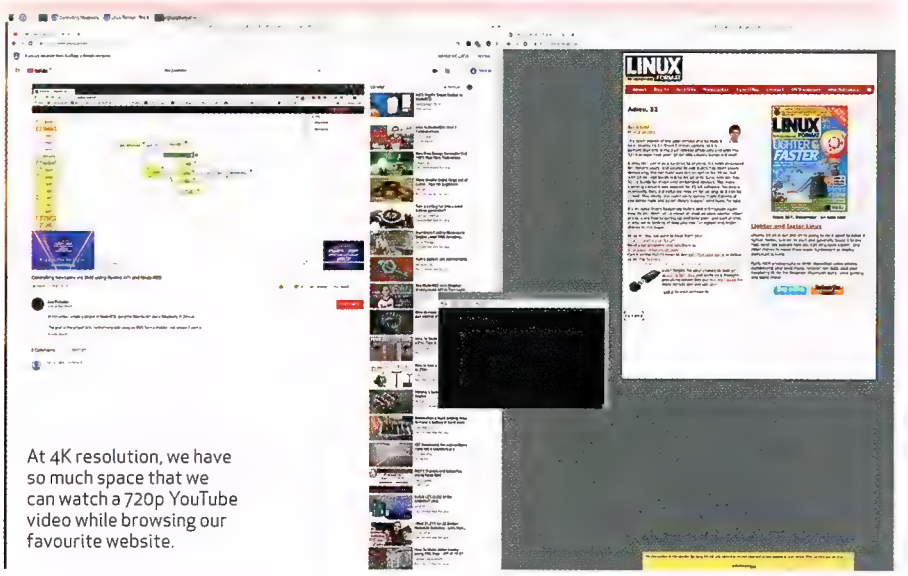
So can we watch 4K YouTube videos? Nope. Unfortunately this is not possible due to inefficiencies with X and Chromium. The best we can achieve is 1080p fullscreen video playback using H.264ify, which is built into Chromium. To play YouTube while working on something else, reduce the resolution to 720p to achieve best results.

## INSIDE RASPBIAN

The Raspberry Pi 4 is only compatible with the latest version of Raspbian, as this comes with all the extra packages and applications necessary for the Pi 4. Download the latest release from **www.raspberrypi.org/downloads** and write it to a fast microSD card using Etcher (**www.balena.io/etcher**) or via dd.

If you are new to the Raspberry Pi, using the NOOBS installer is a quick and simple method to get Raspbian – and it has the added bonus of automatically updating the Pi 4's firmware. This is something that must be done manually with the stock version of Raspbian – we'll cover this later.

The Pi 4 is the first Raspberry that can output 4K video, but on first boot the Pi defaults to 1080p output as this is far more common. To enable 4K output we need to go to the main menu and from there to the Preferences menu. Look for Screen Configuration. When the application opens, click Configure › Screens › HDMI-1 › and then Resolution. The resolution for 4K is 3840 x 2160. Click Apply, or the green tick, to enable the change and after a second the resolution will change to 4K. If the screen goes blank, wait for 10 seconds and the default resolution will return. The default frequency – how often the screen is updated – is set to 30Hz, though this can be changed to 60Hz for a single 4K screen. If you want a dual 4K-screen setup, 30Hz is the maximum refresh – this is the intended use case of the Pi 4 – due to bandwidth limits on the HDMI connection.

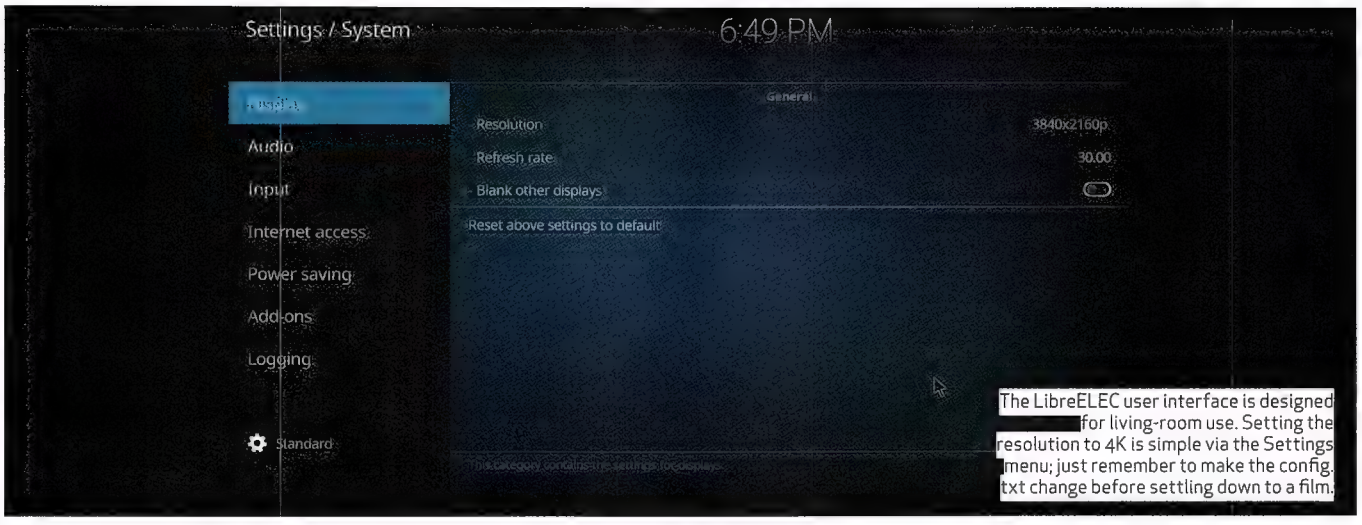



At 4K resolution, we have so much space that we can watch a 720p YouTube video while browsing our favourite website.

## UPDATING FIRMWARE

Firmware is the part between the Pi 4's hardware and the operating system. Firmware updates are important for many devices; on the Pi 4, an update reduces the operating temperature of the VL805 USB 3 controller chip. Why is this important for 4K playback? Well, USB 3 has enough bandwidth to supply large video files from a compatible USB stick at great speed.

The firmware will also reduce the temperature at which the Pi 4 operates by a few degrees, and limit the chances of the CPU being thermally throttled (reduced in speed to prevent overheating). For hardware-decoded playback, the CPU is rarely used; in fact, during our tests we noticed that the CPU ran at around 600MHz when



The LibreELEC user interface is designed for living-room use. Setting the resolution to 4K is simple via the Settings menu; just remember to make the config.txt change before settling down to a film.

playing back 4K HEVC content. For software-decoded content, the CPU is used and will run at maximum speed constantly.

To ensure that your Pi 4 is running the latest software, we first need to update the system. Open a terminal and enter the following commands. At the end of the line, press Return.

```
$ sudo apt update && sudo apt upgrade
```

To install the latest EEPROM tool to flash the firmware, type:

```
$ sudo apt install rpi-eeprom rpi-eeprom-images
```

To check the current EEPROM version type

```
$ sudo rpi-eeprom-update
```

If you see `VL805: update required` , reboot your Pi 4. This will trigger the latest firmware to be flashed.

The stock version of VLC that comes with Raspbian is not able to play 4K content without stuttering, so we need to install an updated version, although this does come with some caveats. This version of VLC is right on the bleeding edge so there will be issues and crashes along the way. If you need rock-solid performance, it's perhaps best to wait for the final update to be released.

To install the latest VLC, open a terminal and type the following to open the raspi.list file which contains the sources from which we can install software.

```
$ sudo nano /etc/apt/sources.list.d/raspi.list
```

Edit the first line, which starts

```
deb http://archive.raspberrypi.org/debian/ buster main
```

Change it to:

```
deb http://archive.raspberrypi.org/debian/ buster main ui untested
```

To save, press Ctrl-X, then press Y and finally Enter.

We now need to reload the software repositories in order to install the untested/beta software:

```
$ sudo apt update
```

Then we need to run an upgrade for the distribution:

```
$ sudo apt dist-upgrade
```

This will install the latest, experimental, version of VLC. Before we can test a video we need to make a change to the /boot/cmdline.txt file so that we can allocate 512MB for video decoding. This is the optimal setting for 2GB and 4GB Pi 4 models.

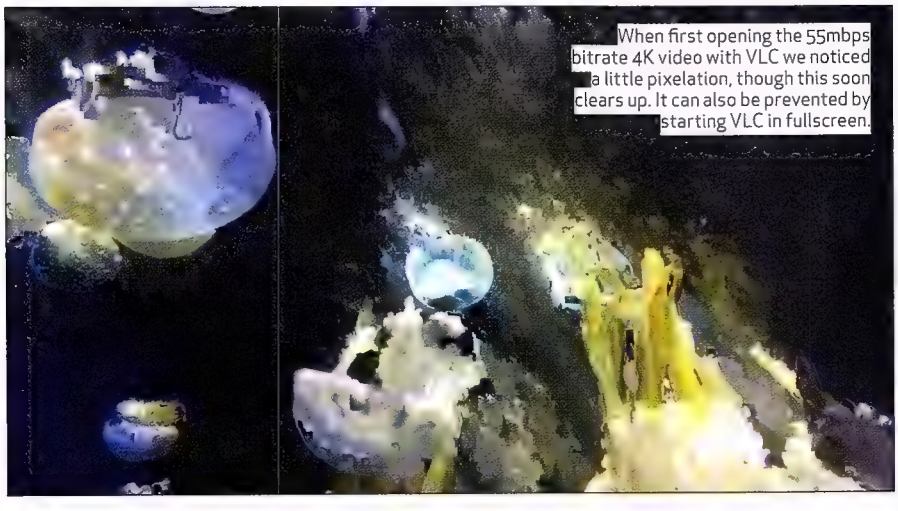
To edit the file, type the following into a terminal:

```
$ sudo nano /boot/cmdline.txt
```

At the very end of the line, type a single space after the last word and add:

```
cma=512M
```

To save, press Ctrl-X, then press Y and


When first opening the 55mbps bitrate 4K video with VLC we noticed a little pixelation, though this soon clears up. It can also be prevented by starting VLC in fullscreen.

## Running a Plex Media Server

For the ultimate media experience, you need the ultimate media server – and Plex (**www.plex.tv**) is just that. This is a client/ server solution that uses a media server – in this case a Pi 4 – on your home network. The server contains all the local audio and video files that you want to use. Plex can serve these files to multiple users and multiple devices at once; it can also transcode videos on the fly, so that your device receives the best possible quality.

Plex Media Server for Raspberry Pi 4 is easy to install – you just need to take each step carefully and slowly. There is a great guide at **https://pimylifeup.com/raspberry-pi-plex-server**.

So why is Plex so good? It offers the ability to stream your local content to any device on your network, so the kids can watch Peppa Pig while you watch Ulysses 31. Your music collection can be stored and referenced with ease. You can also stream live TV to devices around the home, provided you have a TV tuner for the Pi.

If your media requirements are 1080p or less, a Raspberry Pi 3B+ can be used to great effect and still offers great quality for multiple users. It is also a good way to reuse that old Pi.

finally Return. If you are using a 1GB Pi 4, change `512M` to `384M`.

To reduce the risk of crashes or issues, ensure that you stop any video playback before exiting VLC. Best practice is to stop playback by pressing S and exiting by pressing Ctrl-Q.

With VLC installed, we can try out a 4K video. If you don't have one to hand, you can find test files at **http://jell.yfish.us**. We used the 4K HEVC videos to test hardware decoding, and 4K H264 videos for reference. Some 1080p videos in HEVC and H264 formats were used to test 1080p playback quality.

## OVERCLOCKING THE PI 4

If you are prepared to do a little tinkering you can push the Pi 4 to a speed of 2GHz! This step is optional, and while it's of no benefit for hardware-decoded content it will add a little speed boost for software-decoded media. In general, this will provide a noticeable speed-up to Raspbian as a whole.

Overclocking a Pi is simple – all it requires are a few lines in a config file. But it is important to remember that overclocking the Pi 4 will generate more heat and therefore good cooling is required. We covered the best cooling options in *APC 477*, so take a look and pick the best cooler for your build!

We suggest the 52Pi ICE Tower for extreme cooling, but the Fan Shim from Pimoroni is more than capable. You will also need a good power supply; we recommend the official Pi unit for the Pi 4, as it can supply 5V/3A (15W), which the CPU needs to run at high speed.

To overclock a Pi 4, open a terminal and edit the config.txt file in the boot partition:

```
$ sudo nano /boot/config.txt
```

Go to the bottom of the file and add the following three lines to overclock the CPU to 2GHz and the GPU to 600MHz.

```
over_voltage=4
arm_freq=2000
gpu_freq=600
```

To save, press Ctrl-X, then press Y and finally Enter. Now reboot the Pi and you should notice a slight improvement in overall performance.

## ACCELERATED CODECS

The Pi 4 may be all-powerful but there are some limitations to it, chiefly with 4K video playback codecs. The HEVC video codec, also known as H.265, efficiently compresses 4K video into a small file, and with the Raspberry Pi 4 it is now hardware-decoded. We tested HEVC videos, starting with the lowest available 4K bitrate of 120mbps, and the video played well when in fullscreen mode. It had a little stutter, but was watchable enough.

Moving up to 400mbps, sadly all we saw was a slideshow of images and garbled sections of the screen. We tried the 200mbps bitrate as a compromise, and this too was very slow.

You may be now thinking that the Pi 4 is not capable of 4K video playback. But that would be wrong, as the Blu-ray specification states that for audio and video the bitrate should be 48mbps – so the 100mbps video proves that we can comfortably play that. We tested the 55mbps jellyfish video from the aforementioned site and it played perfectly well in fullscreen, and was even watchable when windowed. So you can have true 4K videos on the Pi 4 using Raspbian.

HDR (High Dynamic Range) video is also supported by the Raspberry Pi 4, but at this moment there is no way to take advantage of it. In fact the LibreELEC website mentions this and states that "software support has a dependency on the new Linux kernel frameworks merged by Intel developers [...] in Linux 5.2 and a kernel bump will be needed to use them."

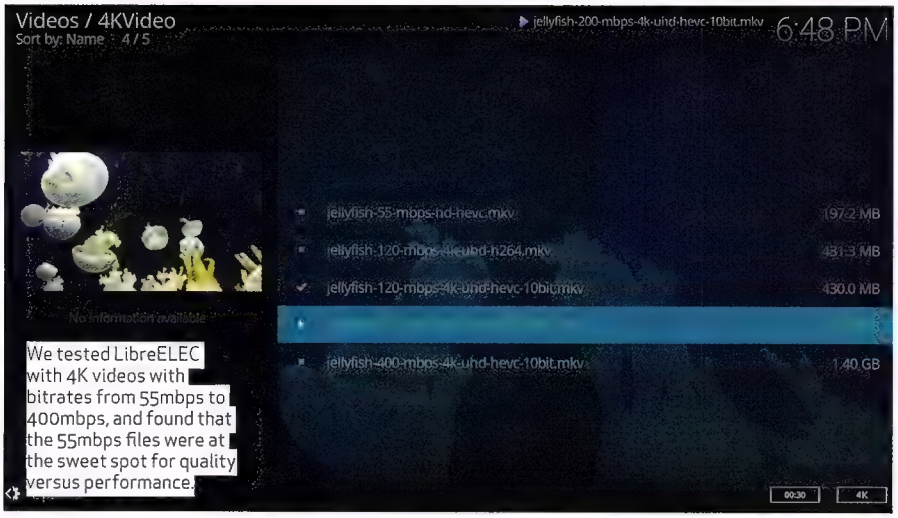
OSMC expands upon this by saying "We plan to support 4K and HDR with Kodi Matrix (v19) builds, which are expected to be released as a stable version by the end of 2020/early 2021." The OSMC team goes on to say that "Presently, the Pi 4 is supported on a 4.19 kernel, so it will be some time before all of the necessary support is there for hardware-accelerated playback and features such as HD audio passthrough." So right now LibreELEC is the best option for 4K video playback, although bear in mind it's still currently at the alpha stage.

## THE LIBREELEC WAY

If you're keen to play 4K video on your Pi, you are also probably interested in home media solutions. The Pi 4 is well-placed to offer a powerful solution thanks to a community of interested parties and products. LibreELEC is part of this community, and the beta for the forthcoming 9.2 release includes 4K playback enabled with Pi 4.

LibreELEC is really easy to get started with. Head to **http://bit.ly/lxf259elec** and click the download link, then scroll down to Direct Downloads and download the Pi 4 version. Write this to a microSD card using dd or Etcher, as previously described.

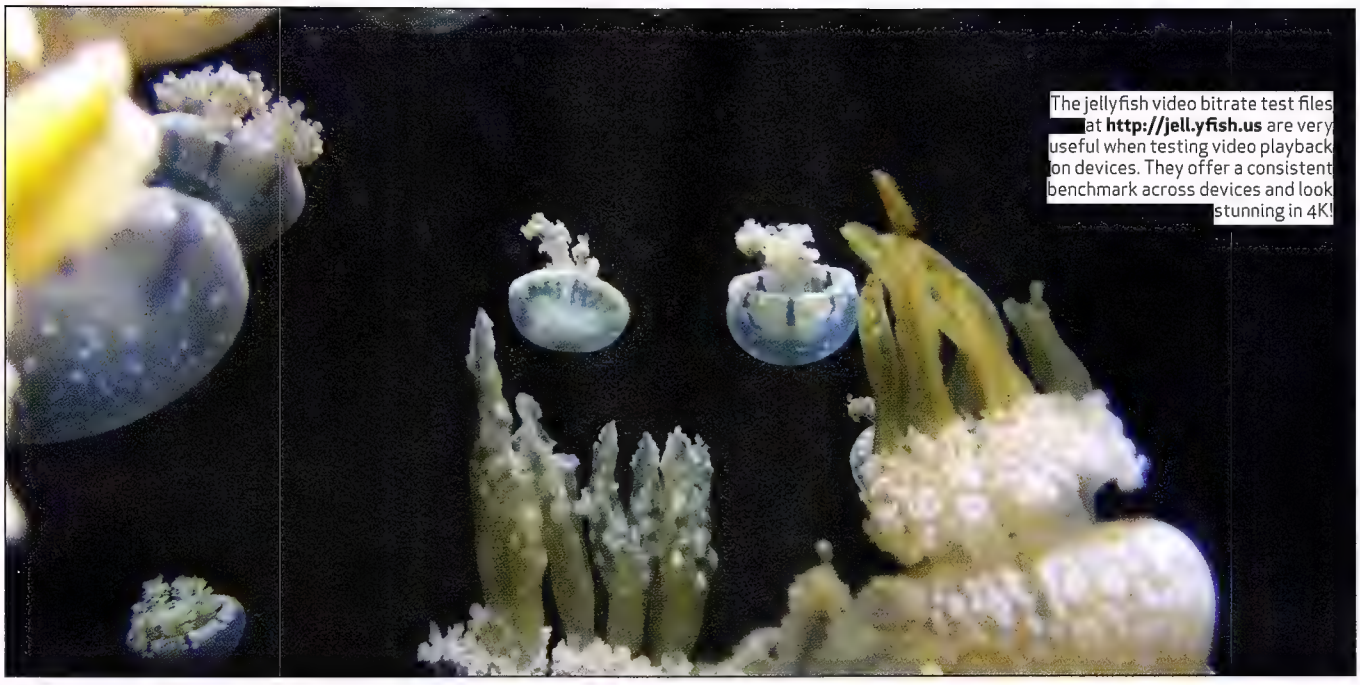
Next, using a text editor open the config.txt file found in the LIBREELEC partition and add the following line to the bottom to enable 4K playback.


Videos / 4KVideo
Sort by: Name 4 / 5
jellyfish-200-mbps-4k-uhd-hevc-10bit.mkv
6:48 PM
jellyfish-55-mbps-hd-hevc.mkv 197.2 MB
jellyfish-120-mbps-4k-uhd-h264.mkv 431.3 MB
jellyfish-120-mbps-4k-uhd-hevc-10bit.mkv 430.0 MB
jellyfish-400-mbps-4k-uhd-hevc-10bit.mkv 1.40 GB
No information available
We tested LibreELEC with 4K videos with bitrates from 55mbps to 400mbps, and found that the 55mbps files were at the sweet spot for quality versus performance.
00:30
4K

## Keeping Your Media Cool

The Raspberry Pi 4 can generate a lot of heat; even at idle, it's around 39°C. If you push the Pi too hard it's possible for it to reach 80°C, which will mean thermal throttling drops the speed of the CPU from 1.5GHz to 1GHz in an effort to cool it down. Running the Pi 4 at high temperatures is not detrimental to the system. In fact, it can survive temperatures far hotter than that; it is reflowed in a solder oven at 250°C, as confirmed by Eben Upton on Twitter!

With the latest firmware, which we installed in this tutorial, we can reduce the temperature of the USB 3 controller chip which contributes to cooling the Pi 4, but we still need some form of passive (heatsink) or active (fan) cooling in order to keep the Pi from reaching that trigger temperature. If you are thinking of building a media centre underneath the TV then a quieter passive solution would be preferable. For a media server tucked away from sight (and sound), the 52 Pi Ice Tower will keep everything nice and frosty.



The jellyfish video bitrate test files at **http://jell.yfish.us** are very useful when testing video playback on devices. They offer a consistent benchmark across devices and look stunning in 4K!

```
hdmi_enable_4Kp60=1
```

Remove the microSD card and insert it into your Pi 4. Power up, and after a short delay during which LibreELEC expands the filesystem to use the full capacity of the SD card, the LibreELEC menu appears. From the menu, click the Settings cog. Then click System and Display. Change the resolution to 3840 x 2160 for 4K playback.

## THE FAST AND THE FURIOUS

We tested LibreELEC with the same series of jellyfish videos on a USB 3 flash drive and found that HEVC 55mbps played perfectly – and looked great! Anything higher than this was a struggle – including the 120mbps file which played well in Raspbian, which was something of a surprise.

We also tested a HEVC 110mbps 1080p video, which played perfectly. For completeness, we downloaded another jellyfish video at 1080p H.264 and this also played perfectly.

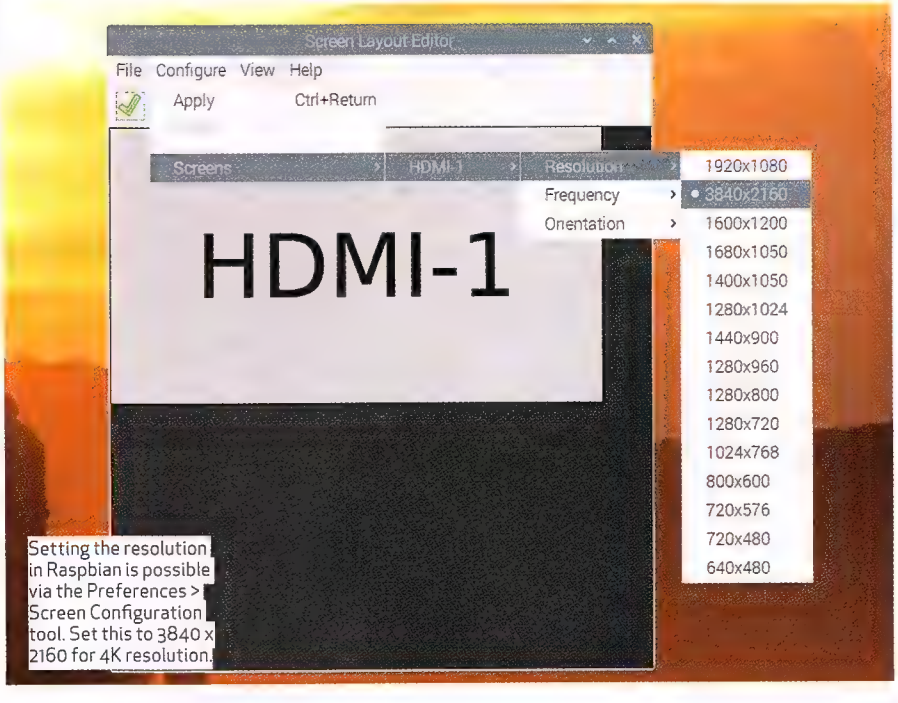
LibreELEC should provide everything that you need to watch local and streamed content, including YouTube and other services. Adding the official Pi TV tuner will also bring live terrestrial TV, including HD (1080p) channels, to your Pi.

LibreELEC can be controlled using a keyboard and mouse, FLIRC-enabled remote controls or via an app available from the Google Play Store. If you have local files on a USB 3 hard drive or flash drive, building a library of content is simple; just point LibreELEC to its location, and it will index and store the media, ready to watch. It will also scrape the details of TV programmes and films from services such as IMDB, providing you with details and image thumbnails for a glorious-looking media library.

For network-accessible sources – for example, a media server or NAS – you will need to connect via the Pi's gigabit Ethernet port for the best transfer speeds: 2.4GHz Wi-Fi is not fast enough for 4K video streaming. 5GHz Wi-Fi is just about enough to stream 4K, but make sure that the signal is strong, otherwise you'll get a lot of buffering.

The Raspberry Pi 4 offers the chance to enjoy 4K media, albeit with a few caveats. With little tweaking and a few untested additions, Raspbian can play 4K video quite well in fullscreen, but it is quite choppy in windowed mode. If you need to build a project that requires 4K video, the Pi 4 – with these tweaks – should provide a stable platform. You can even use VLC via Python, so 4K video playback triggered by sensors is possible. Find out how to do that at **https://bigl.es/tooling-tuesday-using-vlc-with-python/**.

Fixes and updates for 4K video playback will be part of future Raspbian releases, but they're not a high priority at the moment; the main focus for watching 4K media has been via Kodi. If you want to watch 4K video, LibreELEC is the best option – just make sure you keep the bitrate at around 55mbps for the best performance-to-quality ratio. ■

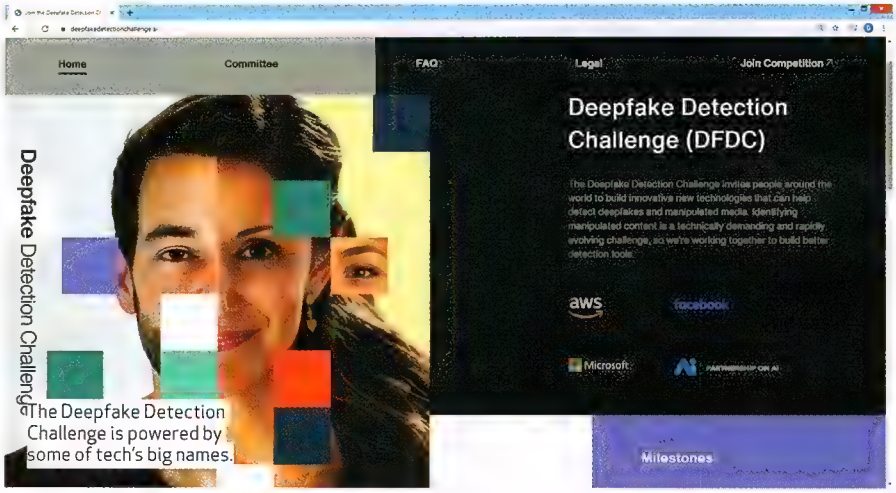



Setting the resolution in Raspbian is possible via the Preferences > Screen Configuration tool. Set this to 3840 x 2160 for 4K resolution.

# Can you spot a deepfake?

Governments and Big Tech are declaring war on deepfakes – and they're using Deep Learning to win the battle. Darren Yates explains.

Actor Peter Cushing passed away in 1994, yet his return as Governor Tarkin in the 2016 Star Wars spin-off movie *Rogue One* showed just how far CGI (computer-generated imagery) had come over the last few decades. However, it also shows how far machine-learning has advanced in the last few years that you no longer need Hollywood-levels of cash to create fictional videos that so convincingly manipulate their subjects into saying or doing things they haven't. The ramifications for society could be huge – and 'deepfakes' have captured the attention of everyone from governments to 'big tech'.



The Deepfake Detection Challenge is powered by some of tech's big names.

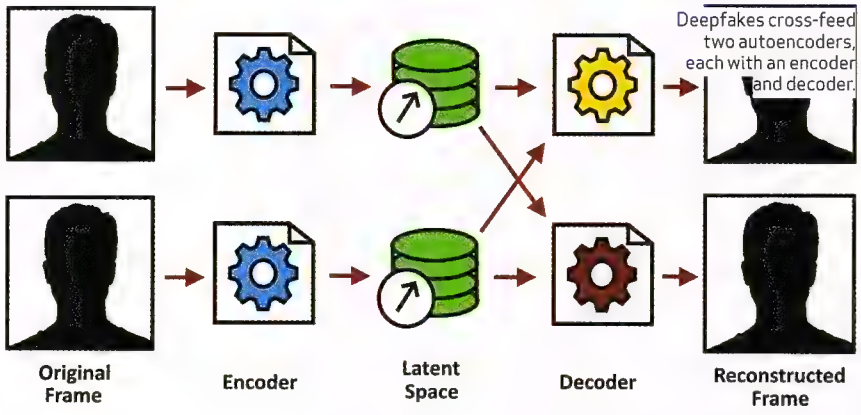
## THE RISE OF 'DEEPFAKES'

Deepfakes are fictional videos created using a form of machine learning called 'deep learning' that place and manipulate the face of one person as if it belongs to another. But it's the level of realism, which can be astonishing, that makes most viewers do a double take at deepfakes and there are plenty of examples on YouTube showing what the fuss is about. The clip of Mr. Bean as Donald Trump announcing his candidacy for the 2016 presidential election, for example, is seriously impressive. But it doesn't take much to see potential ethical issues and how this tech could have far more nefarious uses.

In fact, politicians, governments and 'big tech' are worried. With the U.S. presidential election this year, concerns over the potential for fake videos to sway the result are rising – and with good reason. Recent video appearing to show Speaker of the U.S. House of Representatives, Nancy Pelosi, slurring her speech had reportedly been digitally altered, slowing her speech by 25% while keeping its original pitch. The video circulated widely online. In response, Facebook recently announced a ban on deepfakes from its site. Looking more broadly, as the tech improves, could deepfakes affect the credibility of news journalism or make their way to appearing as evidence in court? If we no longer trust video as a source of identifiable truth, where does society turn now?

## OPEN-SOURCE DEEPFAKE

The first deepfakes would have been the result of handcrafted software scripts, but today, the tools are sophisticated, some with even user interfaces and freely available on Github as open-source software. In the hands of filmmakers, apps like FaceSwap and DeepFaceLab have obvious legitimate uses, so solving the issue isn't as simple as banning the software. In any event, a ban now would be little more than closing the gate after the horse has long bolted – like efforts to ban DVD ripping.



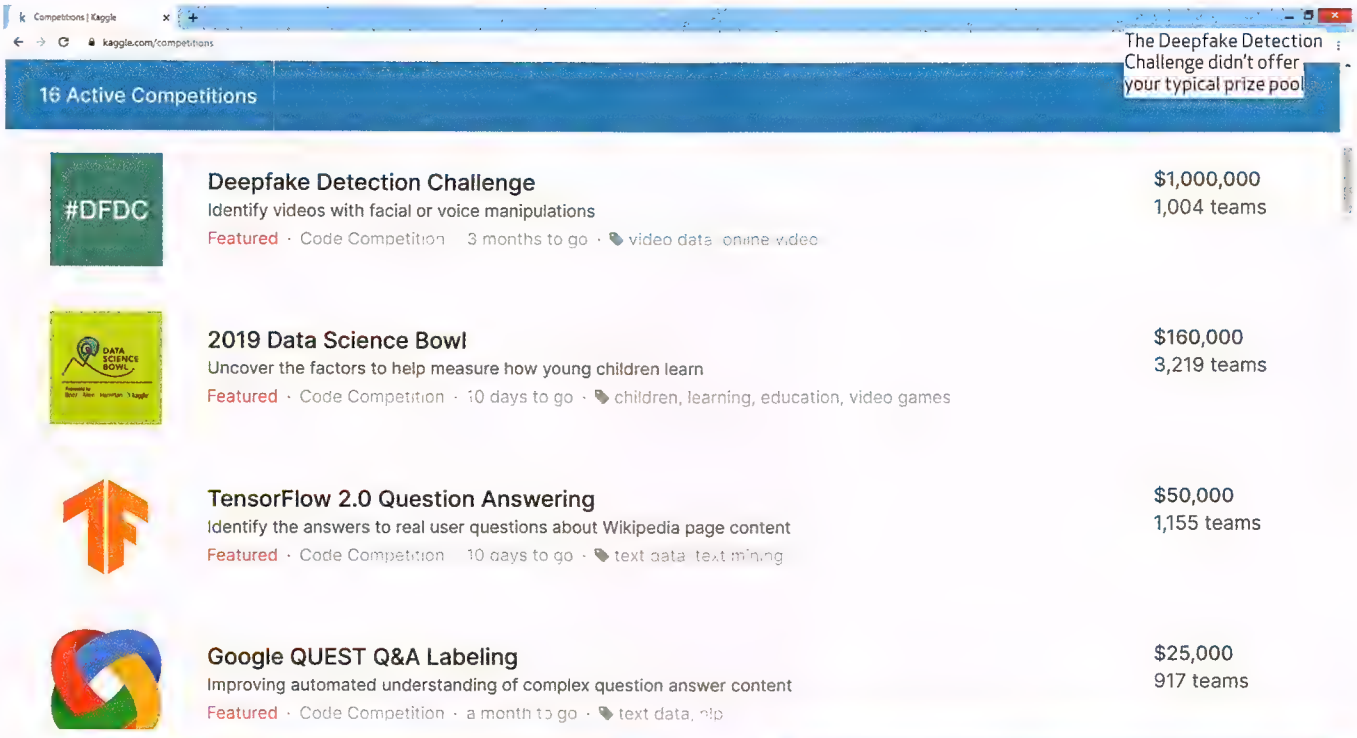

## HOW DEEP-LEARNING MAKES A DEEPFAKE

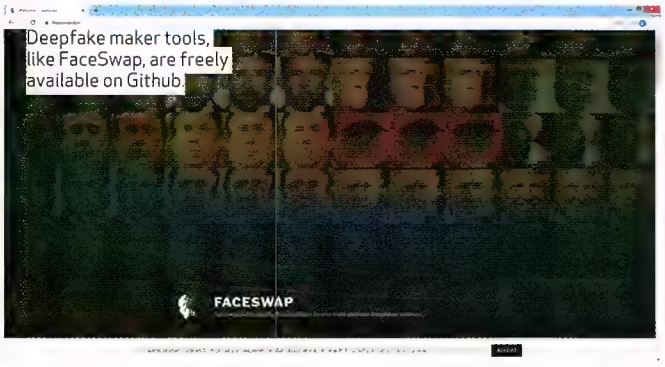
In a nutshell, the process of intelligently replacing one face with another is often built on a pair of neural network processes called 'autoencoders', each consisting of an encoder and decoder. The encoder shrinks down the important facial data into a smaller set of features called a 'latent space', while the decoder does its best to regenerate the original face from the reduced dataset. It's not too dissimilar, at least in principle, to lossy video compression, where only the difference data is retained and saved for each frame. The frame itself no longer looks like the original until it's gone back through the decoder.

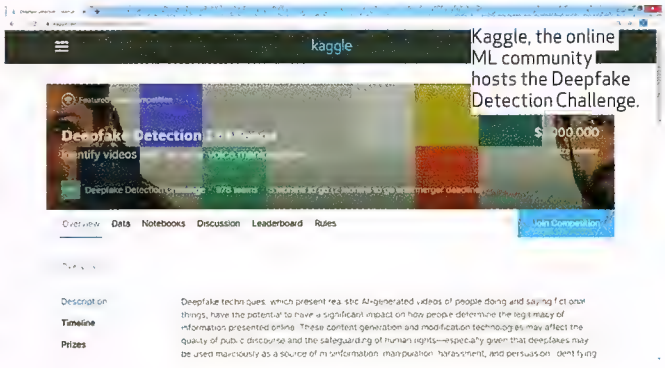
Now say we have two people or 'actors' – a 'source' (the face we want to use) and a 'target' (the face we want to overwrite). Deepfaking takes the encoded data of the 'source' face and applies it to the decoder of the 'target'. The result is the 'source' face on the 'target' image. With two encoders and two decoders, you could also apply the target encoder to the source decoder and get the target's face on the 'source' image. For now at least, the limitation is the process is slow and requires lots of data and CPU speed.

## HOW DO YOU DETECT A DEEPFAKE?

Still, given deepfake's potential to set impressions, Facebook's ban is understandable. However a ban


16 Active Competitions
The Deepfake Detection Challenge didn't offer your typical prize pool
#DFDC
Deepfake Detection Challenge
Identify videos with facial or voice manipulations
Featured · Code Competition · 3 months to go · video data · online video
$1,000,000
1,004 teams
2019 Data Science Bowl
Uncover the factors to help measure how young children learn
Featured · Code Competition · 10 days to go · children, learning, education, video games
$160,000
3,219 teams
TensorFlow 2.0 Question Answering
Identify the answers to real user questions about Wikipedia page content
Featured · Code Competition · 10 days to go · text data · text mining
$50,000
1,155 teams
Google QUEST Q&A Labeling
Improving automated understanding of complex question answer content
Featured · Code Competition · a month to go · text data, nlp
$25,000
917 teams




supposes you have a system that can detect a deepfake to make good your ban. That raises the question – if deepfakes become that good most people can't tell whether they're fake or not, how do you actually spot a deepfake? To borrow from the old adage to 'fight fire with fire', the answer isn't surprising – you use deep-learning.

In this space, the big tech names are turning to the machine-learning community for help. We've previously looked at Kaggle, the online data science/machine-learning community that runs competitions offering cash prizes for the best solutions to complex large-data problems. Prize pools commonly go as high as $50,000, sometimes stretching to $150,000. Right now, the 'Deepfake Detection Challenge', which began in December 2019, is wrapping up, with cash prizes on offer totalling a cool $1million. Still, it's not that much when you consider the 'deep pockets' putting on this competition, names you'll no doubt recognise, like Amazon, Microsoft – and Facebook.

Elsewhere, DARPA, the U.S.' Defense Advanced Research Projects Agency, better known for its robotics challenges, is throwing millions of dollars at deepfake detection projects. Universities, too, are delving into machine-learning research for deepfake detection.

## HOW DEEPFAKE DETECTION WORKS

In general, the aim of detection is just to identify whether or not a video has been manipulated – and like most machine-learning problems, it's solved by training an algorithm with lots of real videos and deepfakes to find some discernible ground-truth. The end-goal is to create a model that can learn the generic differences between 'real' and 'deepfake'. A team at Purdue University in the U.S. published one such detection system that uses convolutional neural networks (CNNs) to identify the key features in each frame, followed by recurrent neural networks (RNNs) to determine if the video is a deepfake or not. The research paper, presented at a 2018 IEEE conference, is at **engineering.purdue.edu/~dgueraco/content/deepfake.pdf**.

The researchers also used other techniques, including looking for small but significant inconsistencies between video frames that have been 'deepfaked' by one of the first such tools called 'FakeApp'. However, some would argue FakeApp has since been superseded by FaceSwap, so whether this detection method is still effective with FaceSwap is uncertain. If nothing else, though, it shows that detection is almost always going to remain behind the curve of deepfake creation tools.

## THE FUTURE IS DEEP

At a basic level, the rise of deepfakes is just another application example of 'deep learning'. But on a broader societal level, deepfakes have such damaging potential, it's not surprising governments are looking to researchers to build weapons to combat the growing menace. You can even imagine Peter Cushing saying 'you may fire when ready'.

# downtime

WHAT'S HAPPENING IN THE WORLD OF FUN, WITH SHAUN PRESCOTT

## Ninja allegedly made US$20-30 million by moving to Mixer

### That should keep him stocked up on hair dye for decades.

Last year, Tyler 'Ninja' Blevins ditched Twitch for Microsoft's streaming platform Mixer. In 2018, he was making US$500,000 a month on Twitch. According to *CNN Business*, that sum amounts to between US$20 and US$30 million to move to Mixer.

His wealth has grown to the point where he can be pretty dismissive about losing tens of thousands of dollars, which he apparently does whenever he spends time doing interviews or events instead of streaming to his subscribers. When he participated in the Fortnite Celebrity Pro-Am in 2018, more than 40,000 subscribers left him, simply because he was away for two days.

According to Justin Warden, CEO of a talent management agency that works with Ninja, Ader, he can afford to lose a few bucks. For moving to Mixer, he claims, Ninja is getting tens of millions. Warden, along with Ryan Morrison of talent agency Evolved, reckon that streamers with 10,000 concurrent views on Twitch could turn that into a $10 million deal with Microsoft, while smaller streamers could still net themselves $1 million.

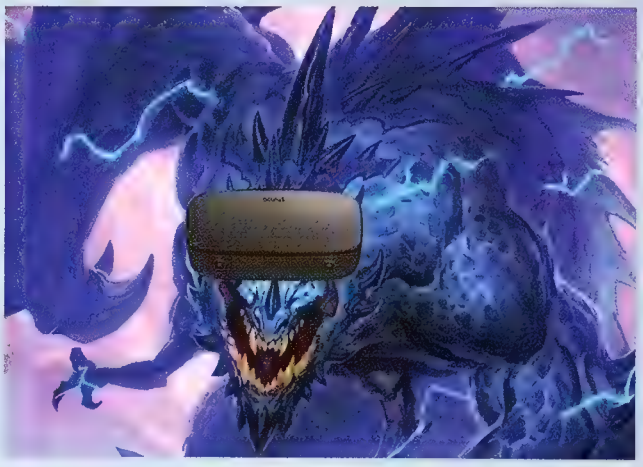
## Hearthstone VR was prototyped by Blizzard

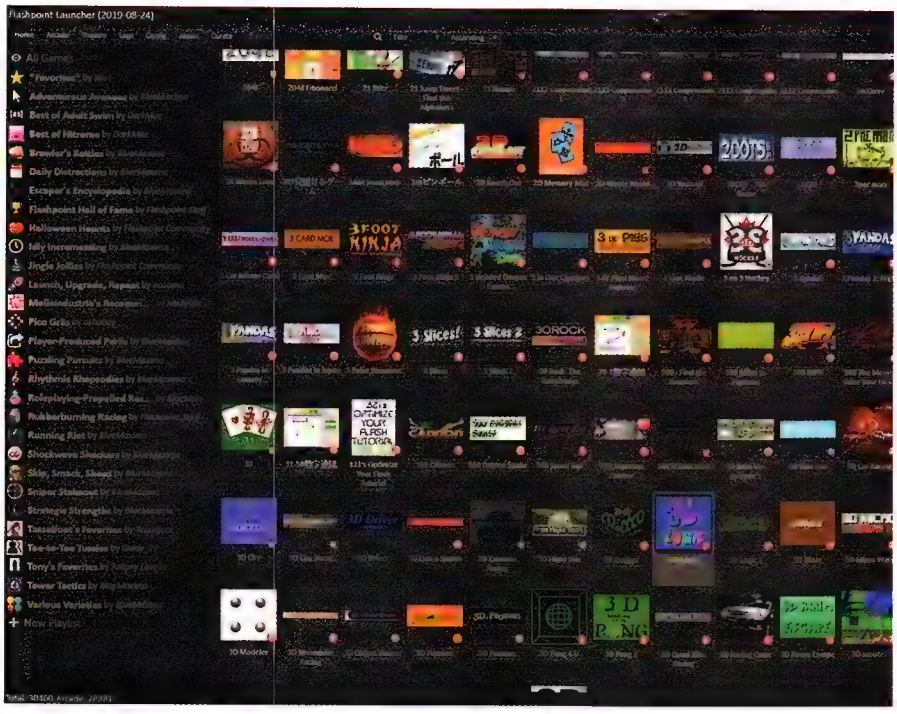
**BUT YOU'LL PROBABLY NEVER GET TO SEE IT.**

*Hearthstone*'s tavern seems impossibly cosy and welcoming, the perfect place for a friendly card battle, but our eyes are always fixed on the board. A VR version that plonks you by the bar and lets you do a bit more than just play cards sounds very tempting, and apparently Blizzard concurs, to the extent that it developed a *Hearthstone* VR prototype.

Chatting to *PowerUp*, lead effects artist Hadidjah Chamberlin mentioned that a pair of developers had created the prototype at an internal Blizzard event, but the chances of any of us ever getting to take it for a spin are extremely slim.

"They actually prototyped a VR version of *Hearthstone* during that time," Chamberlin said. "You could walk around the tavern and sit down to play a game with someone." It didn't go much further, however. "They only had two weeks, so they only got as far [allowing you to] throw cards at the table and you could flip the table over!"





# Thousands of old Flash games have been saved from obsolescence

## A new project has preserved over 36,000 browser games – and they're free to download.

We've known since 2017 that Adobe intends to kill off Flash at the end of 2020. Few will likely miss it, but the announcement didn't bode well for the countless Flash games that proliferated online throughout the 2000s. Thankfully, there's now a launcher that emulates over 36,000 ye olde games – all of which are free and individually downloadable.

That launcher is called Flashpoint, and it's an impressive initiative, especially if you harbour a fondness for quaint browser games of days gone. Using it is as simple as browsing through a (huge) list and double-clicking the game you want to play. This will initiate a download of said game, which will then be emulated by Flashpoint. You'll need the launcher to play the games, because the emulator tricks the games into functioning as if they were still hosted online.

While normally games are only downloaded as you play them, there's also the option to download the full 288GB package at **bluemaxima.org/flashpoint**.

## Nvidia challenges Google Stadia with GeForce Now

**...AND IT'S MUCH BETTER VALUE THAN GOOGLE'S OFFERING.**

Nvidia's GeForce Now game streaming service has been in-development for a while, but in February the company finally launched it – and it's an attractive prospect for anyone disenchanted with Google's meager Stadia offerings. Like Stadia, GeForce Now has yet to roll out in Australia, but its value proposition in America and Europe is promising.

Two tiers are offered: Free provides one hour sessions, after which you'll be thrown back into a queue. Founders members pay $5 a month, have six hour sessions, can jump ahead of Free tier members in the queue, and have access to ray-traced games, which are currently limited to *Wolfenstein: Youngblood*, *Modern Warfare*, *Metro Exodus* and *Deliver Us the Moon*.

It's an interesting system that may not work well in practice, but the real clincher is this: if you own a GeForce Now game on Steam you won't need to buy it again for streaming. In other words, if you own *Metro Exodus* on Steam but want to stream it remotely using GeForce Now, that's possible.

## Doom Eternal will be about twice as long as Doom 2016, according to Id

**"THAT POWER FANTASY, YOU'RE GOING TO EARN THAT".**

Creative director Hugo Martin confirmed that *Doom Eternal* "is a 22-plus hour game" in an interview with *GameSpot*. Raw game length isn't worth much if the game feels padded or otherwise unnecessarily stretched out, but Martin said the studio is "hell-bent on engaging you from beginning to end." The first two or three levels of *Doom Eternal* have more variety on display than the whole first game, Martin says.

## Dying Light 2 has been delayed indefinitely

***DYING LIGHT 2* BECOMES THE NEXT MAJOR TITLE TO MOVE OUT OF THE AUTUMN RELEASE SEASON AT THE LAST MINUTE.**

In a statement announcing the news, CEO Paweł Marchewka said: "We were initially aiming for a Spring 2020 release with *Dying Light 2*, but unfortunately, we need more development time to fulfill our vision. We will have more details to share in the coming months, and will get back to you as soon as we have more information.

## Rockstar co-founder Dan Houser leaves the company

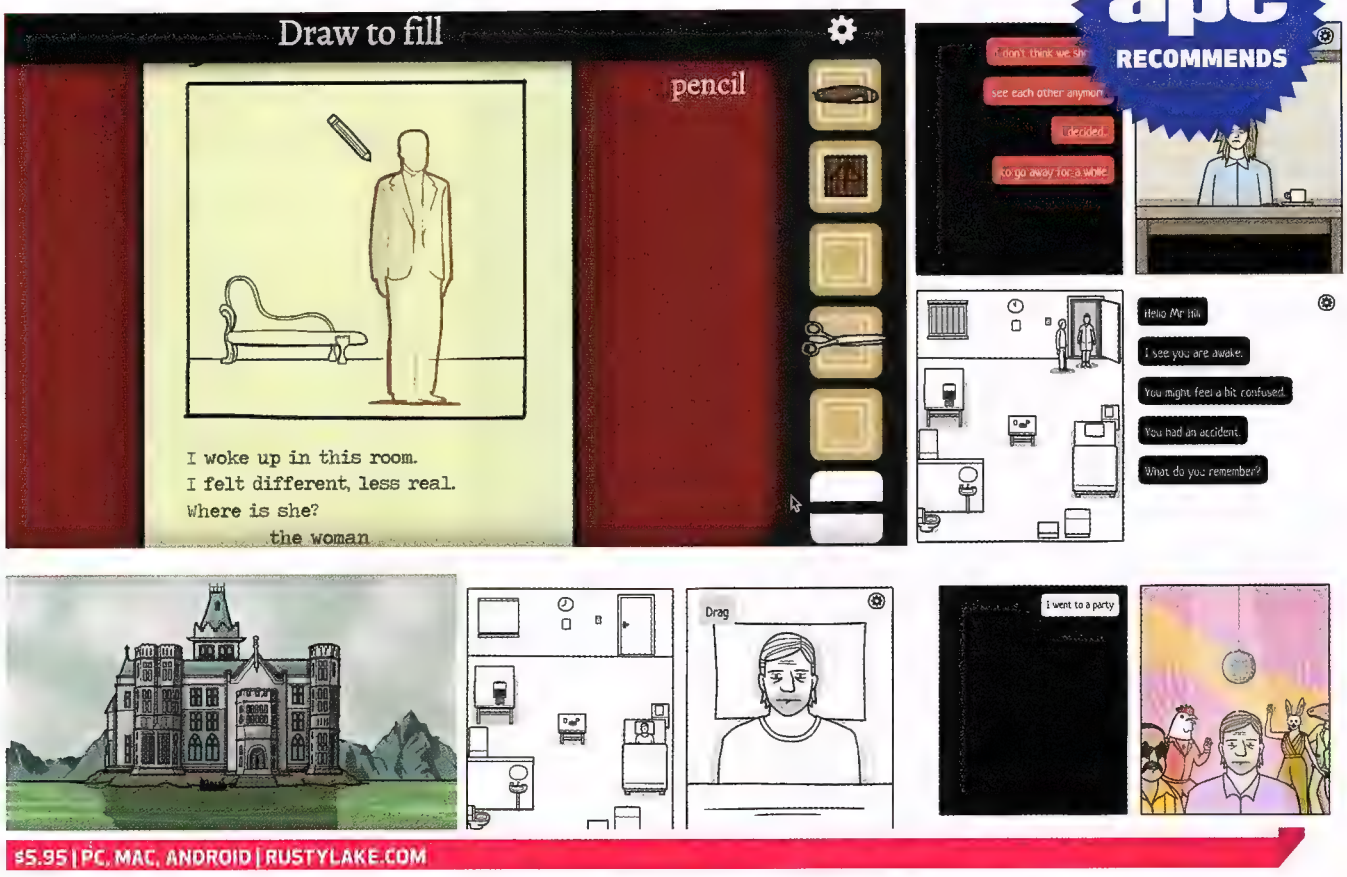
**HE LEAVES A VERY, VERY WEALTHY MAN.**

Dan Houser, who co-founded Rockstar Games with his brother Sam in 1998, is leaving the company in March. Houser was the executive producer on both Red Dead Redemption games, as well as the early 3D Grand Theft Auto games including *GTA 3* and *Vice City*. He is credited as writer on *Grand Theft Auto 5*, which is the fastest-selling entertainment product in history.

## Gears of War studio head will defect to Blizzard

**ROD FERGUSSON IS LEAVING THE COALITION IN MARCH.**

Gears of War studio The Coalition will lose its studio lead in March, with Rod Fergusson starting a new job at Blizzard as overseer of the Diablo series. Fergusson started work on *Gears of War* in 2005 and, aside from a brief stint at Irrational Games during 2013-2014, has been involved with the series during its entire lifespan. Formerly owned by Epic Games but now by Microsoft, the series will continue under the watch of The Coalition, with a new *Tactics*-style offshoot expected to release in April.




apc RECOMMENDS

$5.95 | PC, MAC, ANDROID | RUSTYLAKE.COM

# The White Door

## Beneath simple lines lies a different reality.

An absence of colour can be wielded in media with all sorts of intentions, but the most profound effect monochrome has is to make you notice what isn't there. There's an implication that something's thematically missing when you watch a world in black and white, so we tend to look at monochrome game worlds as a stylistic shorthand for grief, loss, depression, and other such subject matter that can really mess up your Sunday.

That's certainly true of Rusty Lake's *The White Door*, but in this point-and-click-meets ayahuasca journey you're asking the question literally, not just figuratively: what's missing? Small changes to the daily routine imposed by the white coats behind the white door; an empty white plate instead of the meals you're used to receiving at exactly 5.00pm – these feel like major narrative revelations in the minimalist confines of your cell.

You are Robert Hill and the year is 1972. You know this because it's written on the calendar on your wall and the driving licence in your drawer. Otherwise, the wheres and whys of your life, most pertinently how you ended up in a mental health facility, elude both character and player. What follows is a few days of mundane hour-by-hour routine laid out by unseen people who – you hope – are caring for you.

> "The reality-bending tone means you're never sure of the rules."

It's a classic bout of testing the player's obedience, pushing you further and further with prosaic tasks like brushing your teeth, at the same time, every single morning, until you start to question things, pick at the corners of that simple white box you're confined within, and uncover something more complex. Mechanically it's always light-touch. You might be dragging a coffee cup up to Robert's lips as he narrates that he took another sip of coffee in a dream sequence, or answering multiple choice questions during your daily psychological examination. As it progresses it becomes something more like a traditional puzzle game, employing pattern recognition and logic challenges to gate progression, but *The White Door*'s woozy, reality-bending tone means you're never sure of the rules.

Sometimes that's a good thing. It means you don't question why doing X produces outcome Y but just lose yourself to the flow of the journey. In two hours, using art assets that while well-drawn wouldn't look out of place on Newgrounds for their minimalism and resource economy, *The White Door* gets under your skin and makes you feel what it's like to be somebody else. And it does this not with its exposition sequences or puzzles, but by making you live Robert Hill's tightly scheduled life, toilet trips and all. ■ **Phil Iwaniuk**

### Verdict

**Obtuse in its puzzles, yet effective in taking you to another place.**

★★★★☆

$19.35 | PC, SWITCH | VERTEXPOP.COM

# Super Crush Ko

## A one-hit wonder.

It was pretty much love at first sight with *Super Crush KO*, which reminded me of Steven Universe and Scott Pilgrim and Sayonara Wild Hearts. But this is all surface-level attraction, based on appearance and assumption – the kind that quickly fades. Sorry to say, this isn't going to be a love story.

Peel back the impeccable presentation and underneath you'll find a straightforward 2D brawler. Armed with the laser gun and a selection of punches, kicks and dashes, you move left to right, clearing screen after screen of robotic nasties. But *Super Crush KO*'s action lacks zest. As gorgeous as the art is, in motion it's never quite as smooth as you'd hope. Your character feels a little like one of those paper dolls you made as a kid, putting pins in the joints so you could jiggle its limbs.

It's not exactly the kind of combat you'd hold up next to a *Devil May Cry* but, like those games, *Super Crush KO* is constantly marking your performance, with a UI-dominating letter grade sat at the top of the screen. And this is the aspect of the

game I'm most torn about. On one hand, it's the engine that powers *Super Crush KO*. It's seemingly possible to stitch entire levels into a single elongated combo, taking advantage of the special moves that send your character dashing forwards and the range of your laser rifle to ensure there's never a moment of dead air.

On the other, I'm not sure how well this actually fits with every other part of the game. The constant reminder of your current grade means that every moment you're not landing a punch feels like a failure.

Honestly, you don't need to engage your brain much when playing. I quickly found myself reaching for headphones (the music, unfortunately, never rises above the 'serviceable' level) and the game just became a way to keep my hands and eyes busy while I fixed my attention on a podcast. And after a while, even my eyes stopped registering *Super Crush KO*'s ample charm.

■ Alex Spencer

### Verdict

**Floaty combat and repetition make this never more than a pretty face.**

★★½☆☆

## Torpion

### Bird is the word.

**FREE | PC | THELADYVICTORIA.ITCH.IO/TORIPON**

Your home has been invaded by birds. The upbeat music, jaunty colour scheme, and general cuteness of the birds suggests you've invited them here on purpose, and that they're perfectly happy to flap about inside your flat. Naturally, you take pictures of your feathered friends and post them on social media.

There are three phases to this laid-back photography game. The first is exploration, as you search for birds that are doing interesting things. You might find a duck taking a bath, or a cute bird hitching a ride on a roving Roomba hoover. You'll want to whip out your phone and take a photo of these adorable scenes, and luckily that's the entire point of the game.

The next step is to mine your photo for social media standing. A keyboard press uploads the pic to Not Instagram, where it will garner likes and randomised comments. That's *Toripon* in a nutshell. You explore your flat, you take bird pics, and then you share them on the internet. You can do that for as long, or for as little, as you wish. ■ Tom Sykes

★★★★☆

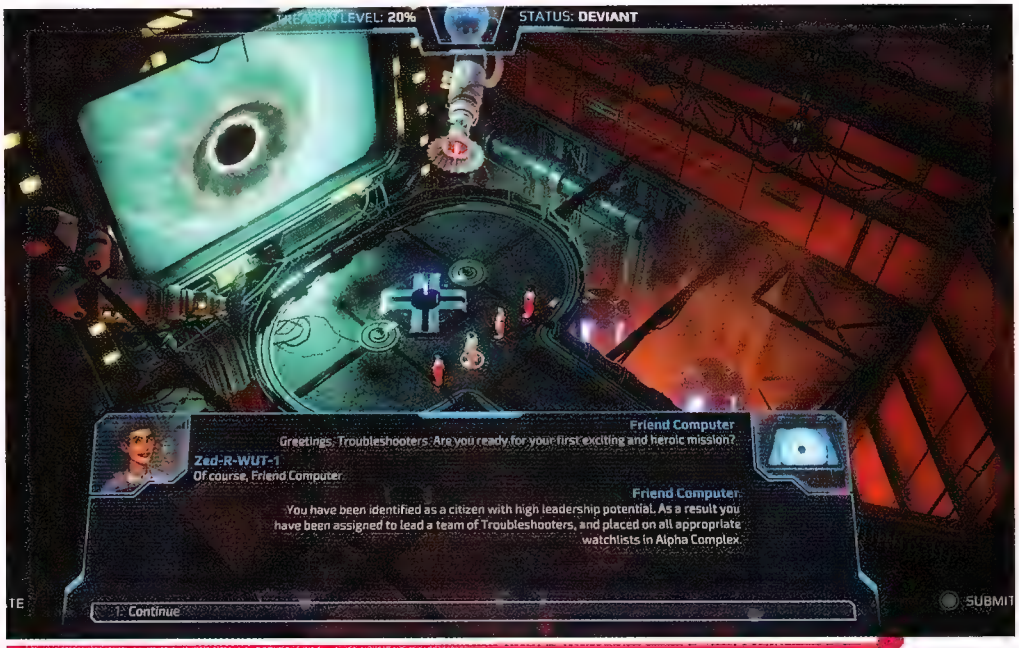
## Sealed Bite

Be the wolf among us.

**FREE | PC, MAC, LINUX | SECURAS.ITCH.IO/SEALEDBITE**

After being bitten by a werewolf, you, a mute traveller, gains the ability to ping through the air, providing there happens to be an enemy nearby. Hold the attack button down and time slows to a crawl, as you select your victim, and then you teleport to their position. You generally use the power to clear large gaps, or to ascend to distant platforms, but it was so satisfying to execute that I found myself using it on pretty much every enemy I came across.

*Sealed Bite* nails its platforming movement, providing you with plenty of tough jumping puzzles as you explore, and backtrack, around its compact world. But where a game like Celeste has been engineered to perfection, this is a game that fosters fury, and rather quickly. Why am I thrown back to the last save pillar upon death, rather than respawning at the entrance to the current room? It's not a problem in the more laid-back Metroidvanias, but, with its precise leaps and its insta-death pits, this is a game rather more keen to murder you. ■ Tom Sykes


TREASON LEVEL: 20%
STATUS: DEVIANT
Friend Computer
Greetings, Troubleshooters. Are you ready for your first exciting and heroic mission?
Zed-R-WUT-1
Of course, Friend Computer.
Friend Computer:
You have been identified as a citizen with high leadership potential. As a result you have been assigned to lead a team of Troubleshooters, and placed on all appropriate watchlists in Alpha Complex.
1: Continue
SUBMIT

**$51 | PC, PS4, XBONE | BIGBEN-INTERACTIVE.CO.UK**

# Paranoia: Happiness is mandatory

Subvert or support an underground dystopia.

*Happiness is Mandatory* is based on the tabletop RPG, and goes meta by parodying that satire. It's witty and brimming with maddening bureaucracy and obfuscating double-speak that's part Joseph Heller, part Aldous Huxley.

You are a clone, born into adulthood in a futuristic underground society called Alpha Complex. It's a rigidly hierarchical place, run by an all-seeing AI called Friend Computer, and filled with subservient people wearing colour-coded jumpsuits that denote their social standing. One small step out of line, and your treason will begin to accrue.

Treason is all too easy to commit in *Paranoia*, and you'll need to quickly learn how to tow the line lest your treason level reaches 100 per cent and you're summoned for incineration by Friend Computer. Speaking out of turn, asking too many questions, or even giving the wrong answers at a confession booth designed to absolve you of your transgressions are just a few of the slip-ups you can make.

I always have time for a game that lets you play the bastard. Double-crossing double-crossers, or executing enemies after smooth-talking some intel from them feels deliciously evil. At these points, *Paranoia* follows the prestigious path of *Disco Elysium* in showing that a well-written game can be compelling with minimal combat.

True to CRPG tradition, combat is real-time with pause. You can direct squad members to get behind cover, flank enemies, and use some cooldown-based abilities, but beyond the bosses the enemy AI rarely tests you. For the most part, you can pew-pew your way through the game with laser rifles, rockets, and the occasional ability. There's a loot system here too, but the limited range of interesting weaponry and armour along with tight and fiddly inventory space means that it's rarely worth the hassle to go through.

It tends to feel a little pointless itself, lacking a clear incentive for you to push through the game. It captures the irreverence of its tabletop source material, but skims over too many details needed to make it a great videogame. ■ Robert Zak

### Verdict

**A witty and weird RPG that doesn't quite follow through on its promise.**

$28.95 | PC, XBONE, PS4 | INVECTORGAME.COM

# Avicii Invector

## Eulogises the Swedish star with mournful passion.

This isn't your average rhythm-action game. The project that aimed to enhance Tim 'Avicii' Bergling's brand of electronic dance and house music by combining it with interactive and mesmeric environments commenced in 2015, but the Swedish club sensation passed away in April 2018 before the game's release. Hello There Games and Bergling's team subsequently finished what had been left off, with a percentage of the proceeds going to the Tim Bergling Foundation, which supports those with mental health problems. It imbues the final experience with profound poignancy beneath the upbeat sheen of the Swedish DJ's party anthems.

That final experience is 25 of Avicii's biggest hits grouped into five distinct, ravishing worlds, and each song plays in a way reminiscent of Amplitude and Thumper. As you endeavour to match each note to the corresponding one on your pad – I prefer this to the keyboard controls, but they work just fine – with the best timing possible on three different lane types that ensure that no song becomes a chore.

First, and most simple, is a flat road where your ship merrily hops from one note to the next, but you'll have to move laterally to hit them all. Then there are the triangular pathways: here you flip the lane onto its relevant side, instead of moving right and left, and manoeuvring the wrong way can throw you way off as notes fly past you, upside down. The third and final type isn't really a lane at all: it launches you away from a path altogether, giving you floating targets through which to zoom.

It's in these moments that the neon grandeur of your environments stand out; eschewing a fixed path completely sees much of the UI disappear, letting you fully appreciate environments filled with towering skyscrapers and craggy cliffs, all pulsating with the track you're playing and exploding with colour.

Of course, determined Avicii detractors will get little from *Invector*, but those on the fence will struggle to remain unmoved as everything falls into place. ■ **Harry Shepherd**

### Verdict

**A sumptuous fusion of sound, colour and love.**

★★★★☆

## Throw it down (to Earth)

### Feline feng shui.

**FREE | PC | 23EDSA.ITCH.IO**

There's a cat on your desk. It's got tentacles and it's purple so it's technically a space cat, but there are no meaningful differences otherwise. Like all cats, probably, the space cat can't resist chasing after a laser dot, and you use this to… ruin all your stuff? Over two stages, you'll frantically wave the dot around, making the cat knock your possessions off the edge of a table. But – and here's the rub – you have to do it without injuring the cat in the destructive process.

Is this a game? A physics experiment? Yes. But those physics feel fantastic, with a satisfying, horrific heft as, say, your monitor tumbles to the floor. *Throw it Down* is that, as a game, but with the added stress of trying to keep the cat topside.

Gleeful chaos eventually gives way to precision ruining. Catharsis gives way to strategy, frustration and innumerable restarts. When it reminds you it's a game, this becomes a lot less exciting. But the relief when you finally beat it is palpable. ■ **Tom Sykes**

★★★☆☆

The longest line for the longest ride in the park.

# SimCoaster

## Managing patrons and puke in this coaster sim.

I placed hotdog stands too close to the entrance of my rollercoaster and now people are puking on the sidewalk. My janitors are threatening to strike because they can't clean the puke up fast enough, but I chose to install bathroom security cameras to stop kids from setting off stink bombs instead. My janitors strike. The puke festers on the ground. People puke from the puke. No one ever said running a theme park was easy.

*SimCoaster* (known outside Australia and the United States as *Theme Park Inc*) tests your ability to play PR, HR, marketer, and designer at the same time. You not only have to manage a robust employee roster of gardeners, security guards, janitors, engineers, and entertainers, but you also have to monitor guest satisfaction with every feature of your park, right down to every last plant. Do well, and you can expand your park into different themed zones, unlock new rides, and grow profits sky high. Do poorly and risk some stern words from unhappy shareholders – or worse, get fired.

### GREED IS GOOD

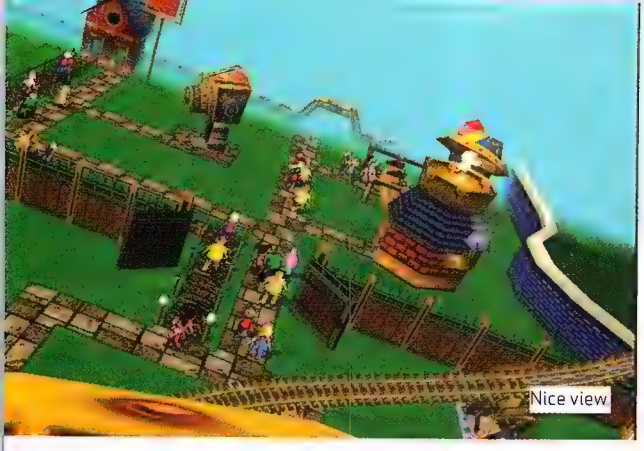
There are a lot of similarities to *RollerCoaster Tycoon*, but *SimCoaster* has a more cartoonish feel, which is probably why my younger brother and I gravitated toward it instead when we were kids. It's a complicated game with a lot of moving parts, going as far to offer you a full business statistics menu, complete with a financial summary and a point-to-point graph that allows you to toggle on/off different categories, such as ticket sales and shop profits, that show your overall gains/losses over a one, three, and 12-year period.

You can even see how many people are in the park at any given time, too, and their arrival rate. I don't know what it's like to run a real theme park, but I imagine it would feel pretty close to this.

*SimCoaster* also breaks down your visitor statistics by age group, the average amount of money each group spends, what kind of rides they go on the most and their most dominant thoughts, which seems Orwellian in itself, since you can also click on any individual park guest and see how they are feeling or what they are thinking in a thought cloud above their heads. Each

### NEED TO KNOW

| | |
|---|---|
| **RELEASED** 2001 | **DEVELOPER** Bullfrog Productions |
| **PUBLISHER** EA Games | **LINK** ea.com |


Nice view

Spy on your guests' thoughts. It's totally ethical.

demographic is going to want different things, so creating an even amount of entertainment for each age group is the key to keeping everyone happy – and if everyone is happy, they are willing to pay more to get into your lovely theme park.

One easy way to boost guest happiness is to plant trees and shrubbery all over your park. People like looking at pretty things, and if they have a bad experience on a ride or at another type of attraction, a well-groomed plant will help take their mind off it. Of course, this will cost money, but it costs even more to keep these plants from turning into sad, brown husks.

## GARDEN STATE

Gardeners are a necessity in that case, and you can direct their work in a few different ways. You can let them roam the park and pick up work on their own, but that's not efficient, and sometimes they'll spend more time hanging out in the breakroom.

You can click on a plant that you want them to pay attention to and the nearest gardener will tend to it. Or you can become a micromanaging boss from hell and assign them to patrol a specific area. This is a great deterrent against children lighting your plants on fire (*SimCoaster*'s children are pyromaniacs), but it's a quick way to drive down your gardening staff's morale.

You can control the other park employees the same way too. I ended up putting the most employee wages toward security, since those dang kids kept playing pranks and setting off stink bombs in the bathroom. Most of the time the guards catch the delinquents, with the help of some strategically-placed security cameras, but you can also click on the kid to summon a guard to their location. Once a guard catches up with them, they stuff the kid in a beige sack and toss them out of the park. This method also works on adults and elderly patrons who complain about your establishment to other guests. The game will actively encourage you to 'deal' with them, and I have no problem with that. Years of torturing families in *The Sims 3* and 4 have hardened me to the point that even giving old grandmas the boot no longer fazes me.

Of course, if you overwork your employees, they'll strike until you raise their wages. Thankfully, you don't have to worry about other legal necessities like health insurance

**"Kids kept lighting fires and setting off stink bombs in the bathroom."**

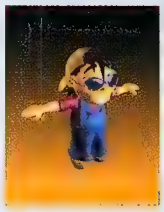
### TOURIST-TRAPPED Why are they complaining? Let's find out!

**FATHER**
Annoyed that his camera got wet on a water ride.

**MOTHER**
Wishes the candyfloss was as big as her hair.

**GRANDPA**
The arcade machines stole all his pocket change.

**GRANDMA**
Angry about eating a very undercooked hot dog.


**KID**
Finally getting kicked out for being a little shit.

All the food.

Smile, kid. You're in a theme park.

and workers compensation, but equally real theme park managers probably don't have to deal with their janitorial staff downing mops after a kid stink bombed nine of your ten bathrooms. Luckily *SimCoaster* will let you raise their wages as much as you like... even if it drives your theme park into ridiculous debt.

Another important part of retaining employees and growing your park is giving them extra training. Janitors can't put out fires if they haven't been on a firefighting course, and you can't expand into certain areas if you don't have an engineer that can blast through rocks. More training means more responsibility, which means they'll naturally ask for even higher wages, but you'll do the right thing and pay them what they deserve, right?

Besides managing guests and employees, winning challenges is the most crucial part to running a successful theme park. They allow you to expand your park to three differently themed lands, and unlock new rides and concession stands.

The Land of Invention is where you start *SimCoaster*, a plush green landscape bordered by a bright blue river. After completing challenges to expand that section you unlock the Polar Zone, a winter wonderland. The final section you gain acccess to is Arabian Nights, which is a stereotypical Middle Eastern land – with its snake charmers and scarab go-kart rides, it does feel a bit... old-fashioned in 2020.

## LAND GRAB

But when the decor isn't abrasively mashing different cultures together, it looks darn cute. Every time you build something new it springs up like a building in a pop-up book. Every umbrella, windmill and telescope move dynamically. You can even hop on one of your roller coasters in first person and see everything you've built from above.

If you don't put enough trash cans near a heavily populated concession area, guests will throw their trash on the floor. (OK, sometimes they throw their trash on the floor even if they are by a trash can. Sometimes they light them on fire, too.)

## PARK FACTS

**Add these to your next trivia night**

1 The game earned a 75% score in on Metacritic.

2 This is the third game in the series, the first of which came out five years before *RollerCoaster Tycoon*.

3 This was the last game put out under the Bullfrog Productions name – in 2004 the studio merged with EA UK.

Not enough snowmen to keep people from puking.

Every detail, beautiful or stinky, makes your theme park feel like a theme park.

And the best part about running being the boss is hiring scientists to research new rides for you. After you complete enough challenges and earn enough money you can choose what type of ride you want them to design next, whether it's a bone-soaking water ride or a little arcade game that's easy on grandpa's sensitive heart. The core of any theme park is pulling in guests with some cool, new attractions, and *SimCoaster* lets you build so many of them.

Not only that, any coaster-type ride, a traditional coaster, water ride, or go-kart track, is fully customisable; you're only limited by your imagination and the amount of space you left yourself to build it. Build loops, tunnels, bridges – just don't do what I did and put all the concession stands near the roller coaster with three loops and a long corkscrew.

## CHALLENGE ACCEPTED

*SimCoaster* wouldn't be a complete theme park management sim without some appropriate challenges – oddly, these only start once you manually activate them. You'll find yourself taking advantage of a heatwave and pushing up the prices of ice cream and cold drinks. When it rains, jack up the prices of umbrellas and hot food. Certain challenges you'll have to complete as part of a larger objective, which mostly has to do with expanding your park or getting promoted. But there is little room for error – fail a few challenges and it's game over, you're fired. A lot of the challenges repeat, though, at least in theory.

> "A vomit-soaked theme park is the quickest way to drive down profits."

Both the Land of Invention and the Polar Zone each have an overstock challenge in which you must sell a certain number of hot dogs and drinks in a certain matter of days, respectively. One is easier than the other, but if you get crafty with the settings of each individual food and drink stands, you'll psychologically trick your guests into purchasing exactly what you want them to purchase. The fries stand, for instance, allows you to change the amount of salt they have on them. Super salty fries will drive people to buy more drinks, which will drive up those profits.

You can also build info kiosks around the park to advertise specific concessions stands to drive more people to them.

There are many more nuances to *SimCoaster*, and I feel like I'm discovering them over again as I play through this 18-year-old game. It's still as involved as I remember it, and I'm still a terrible business owner, but I don't mind. I will always enjoy kicking out the little pyromaniacs that keep setting my plants on fire and riding my own roller coasters in first-person mode. ■

» JOEL BURGESS REPORTS ON THE UNUSUAL SIDE OF TECH NEWS.

# Atari themed hotels to open across the US

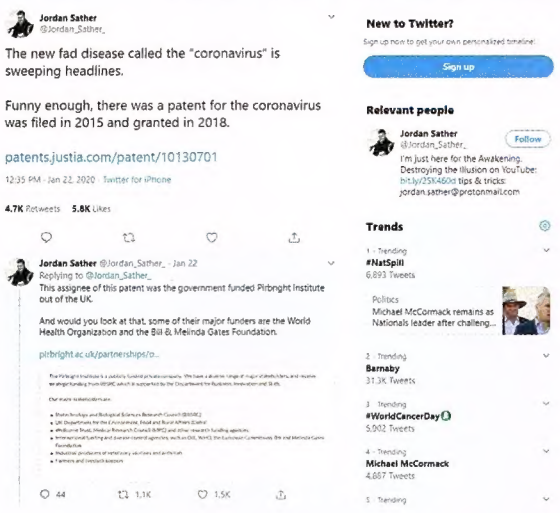
## There's a new kind of gaming tower in town.

Atari has long since been a cherished relic of gaming history and while it had a crack at revitalisation in 2018 with a successful crowdfunding campaign for a retro-looking console that should begin shipping this year, the company and its aesthetic has largely remained frozen in the 80s. This seems to be a big part of the appeal for one hospitality developer, who bought a licence to build eight Atari-themed hotels across the USA. In addition to all the usual things hotels contain, each of the Atari buildings will be designed with a dedicated eSports arena and a retro gaming arcade.

## Qanon supporters accuse Bill Gates of masterminding coronavirus outbreak

### CORONAVIRUS NOMENCLATURE IS CONFUSING ANTI-VAXXERS INTO THINKING THERE ARE ALREADY VACCINES.

In January 2020, following the international discovery of a novel (or new) coronavirus that apparently emerged in a food market in Wuhan, China, websites formerly propagating the right-wing conspiracy theory known as QAnon began publishing that Bill Gates was responsible for the current pandemic. Jason Sather, a QAnon YouTuber, told his followers that the Wuhan coronavirus was a "new fad disease", claiming the outbreak was "planned", while another QAnon Twitter account, @chiefpolice2, recommended that the coronavirus could be cured by drinking a bleach product called 20-20-20 spray. Sather also falsely suggested to his Twitter followers that a 2018 patent for an avian coronavirus vaccine lodged by the Pirbright Institute (which has received donations from the Bill and Melinda Gates Foundation) was the same strain as the current human coronavirus.


Jordan Sather
@Jordan_Sather_
The new fad disease called the "coronavirus" is sweeping headlines.
Funny enough, there was a patent for the coronavirus was filed in 2015 and granted in 2018.
patents.justia.com/patent/10130701
12:35 PM · Jan 22, 2020 · Twitter for iPhone
4.7K Retweets 5.8K Likes
Jordan Sather @Jordan_Sather_ · Jan 22
Replying to @Jordan_Sather_
This assignee of this patent was the government funded Pirbright Institute out of the UK.
And would you look at that, some of their major funders are the World Health Organization and the Bill & Melinda Gates Foundation.
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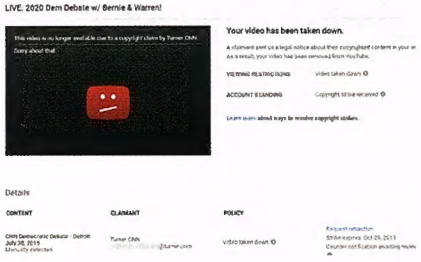
## German artist creates Google Maps traffic jams

### 99 PHONES USED TO CREATE MYTHICAL CONGESTION.

German performance artist Simon Weckert accumulated 99 functioning smartphones from friends, family and colleagues and walked them along some quiet streets in Berlin to make it look like there were traffic jams on Google Maps. The flow rate on roads is updated continuously by Google using 'aggregated anonymised data' from people with location data turned on. While there are some systems in place to determine if individuals are walking, riding or driving; dragging a large number of devices in a hand-pulled trailer down the middle of the road is something Google hadn't planned for and was enough to create widespread digital traffic jams.

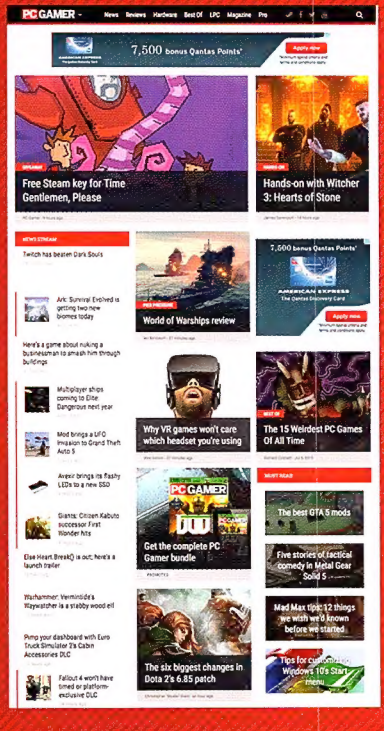



## YouTube removes non-existent content for copyright infringement

### TERMS OF SERVICE OFFER A GREAT WAY TO SKEW UNWANTED POLITICAL CONTENT ON YOUTUBE.

When you livestream on YouTube you have to pre-arrange the feed so it's ready to run the second you start recording and that is just what political podcaster Matt Binder did for his planned live coverage of the CNN Democratic Primary Debate in Iowa, before it was taken down for copyright infringement. The left-leaning podcaster was planning to livestream an interview with a guest speaker that summarised and commented on the debate, but received a copyright infringement strike after Warner Bros. Entertainment (the owner of CNN) complained that his live stream contained infringing content – even though there was no actual content at that point. YouTube's updated terms of service mean that one strike is enough to revoke live streaming permissions, apparently, at least in this case, even if it's for not yet created content.

# SMARTER COOKIES ENABLED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